Distribution of Electric Power in Factories—Outdoor Substations for 33,000-Volt Circuits—and other articles

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Electrical World

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Weston

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Not one of the Transformers thus obtained in this country or abroad even approximately met the requirements.

The Weston Company did not want to make Transformers, because of other work it deemed of greater importance; but failing to find Transformers that it could recommend to be used in conjunction with Weston Instruments with assurance of accuracy better than 1 per cent for the combination, it endeavored to have them built to special designs. Even then the results were far from satisfactory.

Realizing finally that the problem of Instrument Transformers was one that must be solved as other Weston problems had been solved, the Weston Engineering Staff thoroughly analyzed the subject and completed designs for various groups of Portable and Switchboard types of Current and Potential Transformers of a degree of accuracy and serviceability that completely met the practical requirements of switchboard practice and precision determinations in the laboratory.

These Weston Transformers established a new standard for Instrument Transformer design and construction.

As might have been prophesied, the improvements made by the Weston Company resulted in improvements on the part of other instrument manufacturers, and this is one more instance of apparatus remaining stationary, so far as merit was concerned, until a Weston type blazed the way for betterments. The significance of this is apparent.

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Weston Switchboard Instrument Transformers described in Bulletin 1501.
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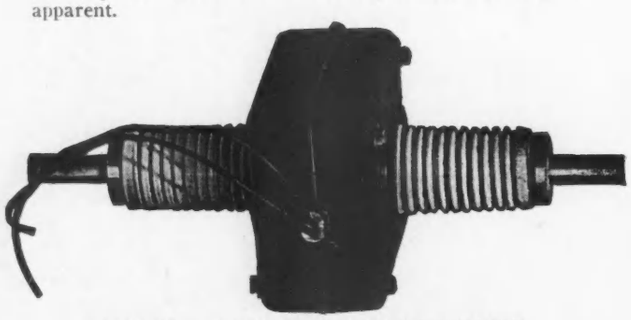

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Weston Electrical Instrument Co

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Effective Distribution of Factory Power

NOTWITHSTANDING the efforts made to direct careful attention to the problem of motor application in factory work, there is every likelihood that distribution circuits for supplying the motor and lighting equipment in many factories will not receive the necessary consideration unless special thought is given to them by the management. It is reasonable to expect that in a new plant the distribution circuits will usually be planned with due care to meet the initial needs. The typical factory, however, and more particularly the machine shop, requires continual rearrangement of machinery, and the tendency of the electrical department, in meeting calls for hurried changes in positions of motors, is to utilize as far as possible the existing wires in the various sections of the plant. One natural result is confusion in the circuits, with unbalanced load conditions, excessive power losses and an undue voltage drop in the overloaded circuits and accompanying reduction in production of the machine tools or other machinery supplied.

In his article in this issue on the distribution of electric power in factories Professor Clewell touches upon a timely and important part of the motor application problem, one which has a particular relation to efficiency of production. Sometimes, as the article points out, there is a tendency to forget that the electric circuit is the vital connecting link between generating machinery and motors or lamps. It thus takes the place of line shafting and belting with their high mechanical losses, and introduces more effective means for power supply and at the same time makes longer extensions possible than could be realized with the older mechanical methods of distribution.

Their very flexibility is one reason why circuits are overlooked so easily and are allowed to become inferior to the well-balanced status which may have existed when the plant was constructed. Professor Clewell emphasizes in a practical manner methods whereby one of the larger manufacturing establishments reduced circuits to diagrams or "wiring maps" which form part of the records of the electrical division. Several methods of preparing such charts are outlined, together with ways of keeping them up to date and promoting their regular use in wiring work.

The value of suitable standardization for the factory distribution system should not be overlooked, since the addition of equipment must be governed, in part at least, by the adaptability of apparatus on the market to the classes of circuits available in the plant. As the article indicates, a leading consideration in the lighting equipment, although it may be relatively unimportant in the motor problem, is that of maintaining rigid separation of power and lighting circuits so that the latter may be protected against voltage variations probable as a result of changing load conditions imposed on the motors.

When advocates of scientific management look upon a 1½ per cent improvement in production efficiency as sufficient to warrant extended efforts to better the manufacturing methods, any part of an electrical system like the supply circuits demands sufficient attention to insure the maintenance of highly effective operating conditions.

International Standardization

THE proceedings of the International Electrotechnical Commission have been temporarily arrested by the war, but the standardization work goes on in individual countries in directions mapped out by the previous work of the I. E. C. The standardization rules of the American Institute of Electrical Engineers relating to the performance of dynamo-electric machinery have been developed steadily during the last five years, and also the corresponding rules of the British Engineering Standards Committee. The twelfth report of the latter body has been published recently. It states and epitomizes the eighty or more individual published reports of the various sub-committees. During the last three years three conferences have been held between the American and British electrical standards committees for the unification of their respective rules. Quite recently, as was stated in last week's issue, H. M. Hobart, representing the A. I. E. E. standards committee, has been attending the rating conference of the British committee.

As a result of these conferences the electrical standardization rules in England and in America are substantially alike on all essential points and are also in conformity with the rulings of the I. E. C. so far as that body has yet been able to act internationally. This degree of uniformity is not only a matter for congratulation to both of the national committees involved, but it is also an international asset of great scientific, technical and general commercial value. So far as it is of commercial benefit to each of the two countries to formulate similar rules for the standardization of machine performance, it is also of like commercial benefit to other countries, which similarly gain in understanding clearly the nature and characteristics of machinery standardized either in Great Britain or in America.

Sooner or later we may hope to secure an international set of rules for the standardization of electric machinery whereby a machine correctly rated in any part of the civilized world will have definite and defi-

nitely understood performance characteristics. There is no good reason why such characteristics should be dependent upon geographical co-ordinates of latitude and longitude.

Problems Relating to Magnitude

THE very interesting paper by A. O. Austin published in our last week's issue suggests some reflections which extend far beyond the reliability of insulators and related problems. The improvements of the last few years have gone far to lessen the difficulties of insulation as such. The chief trouble with insulation in the past has been an altogether inadequate factor of safety. As Mr. Austin very properly notes, the insulation must be reckoned with reference not to the nominal voltage of the line but the greatest voltage to which it may be subjected. In its broadest aspect this includes not only surge voltages, themselves highly formidable, but those due to the interference of lightning. It is a well-known fact that high-tension lines are not the chief seat of damage from lightning. If a system working at from 50,000 volts to 100,000 volts has insulation which will stand at a pinch 250,000 or 300,000 without flashing over, it is relatively immune to the ordinary strains of lightning discharges. A direct stroke may be of a magnitude which no practicable insulation can withstand, but the larger part of troubles from lightning are of limited voltage, high indeed, but not beyond control. Thus a line which has the insulation strength just referred to could stand an additional pressure of 100,000 volts to 150,000 volts and probably discharge it harmlessly through the arresters without breaking down the line insulation. On the other hand, a much less severe stroke would cripple secondary lines.

In other words, one may regard the majority of disturbances due to lightning as producing an increment of pressure on the line which may be dangerously large on a secondary system and not at all serious on the primary. This is merely a question of the absolute, and not the relative, factor of safety; hence many of our big high-tension distribution systems have come through excellently well on the primary side in spite of suffering in the secondary lines from local thunderstorms. In this way the magnitude of the transmission voltage for which the insulation is designed for some reasonable factor of safety may actually increase the reliability of the system as a whole. In the same way surging is profoundly dependent upon the magnitude of the currents involved, so that a secondary system carrying great amounts of energy may put up terrific surge voltages compared with anything contemplated in the normal insulation of the lines. Broadly, of course, Mr. Austin was quite correct in reckoning on a great increase in liability to trouble with increase of extent of lines, owing to the fact that every part of the system may react on every other part and that additional lines mean not only additional length but additional consumers and complexity of service. It would perhaps be unsafe to attach too much importance to any numerical reckoning of these added risks.

There are several human factors, too, which enter this situation and which cannot be even approximately evaluated. A very large and lightly loaded system seldom gets the careful inspection of a more restricted and heavily loaded system, so that the possible risks per mile of line are quite certain to increase from this cause irrespective of all others. There is, however, a contrary factor which has made itself felt most beneficially in many of the great distributing networks. This is the cushioning effect of very long lines on local disturbances. The mere resistance of the circuits is an important factor in the fading out of surges which in a short line of low resistance might reach a point where great damage would result. It therefore happens that many widely extending systems with numerous stations feeding into them have exceedingly little trouble due to the mutual effects of their several parts, while they would be very likely to experience relatively more were they of greater output for the same extent of lines. Reliability is not merely a question of extent but of many other factors, including the nature of the service and the distribution of the load. One suggestion of Mr. Austin's with respect to the difficulties of increased line mileage, and particularly of additional circuits, must be taken very seriously in this connection. This is the desirability of segregating load, at least certain kinds of load, at certain times so as to lessen the risks which may spread from one part of the system to another.

The operation of every line from a common set of busbars linked to a common set of generators operating in parallel is a very attractive and symmetrical sort of idea. It means, however, a possibility of surges and short circuits on an enormous scale, and it also means extraordinary increase in the station switching facilities. In principle, if one has ten generators in parallel each must be equipped with switching apparatus to control the current of the whole ten, and the actual result of this requirement has been a relatively very large increase in the cost of switchboard equipment. Sectionalizing the plant, in its normal operation at the least, is therefore a somewhat useful resort, and in many instances it may be found desirable, on account of the particular nature of some one load which has to be carried, to operate this load for the most part independently of the rest. The penalty may, of course, be slightly lessened generator efficiency, but on the other hand, if the load distribution is skilfully done this penalty may not be in practice exacted. Another practice carried sometimes to excess is the habit of running everything in parallel on the low-tension side, when it is really sometimes more desirable to parallelize through the transformers at the end of long lines. It is not really necessary that any feeder, *A* to *Z* inclusive, should be able to be fed at will from any generator, *A* to *Z* inclusive. The real necessity is that some generator should be ready to take up the burden of any specified feeder. The bigger the plant operated fully in parallel the more terrific the shock of a short circuit, and while "shorts" are always "undesirable citizens" the bigger they are the worse for the system.

Harmonics in Transformer Exciting Currents

THE method generally adopted in determining the harmonics in the alternating current supplied to a transformer is to take an oscillogram of this current, find the wave form, and analyze it, by any of the regular methods, into Fourier components. It is well known that if a lighting transformer, with its secondary circuit open, is connected to primary alternating-current mains maintaining a simple sinusoidal emf., the voltage induced in the secondary winding will be very nearly sinusoidal; but the current taken by the primary winding from the mains will be non-sinusoidal. This primary current will contain, ordinarily, a marked peak and a correspondingly marked triple harmonic component. There will also be other and higher harmonic components. The magnitudes and phases of these harmonics in the primary current of the transformer will depend upon the quality and dimensions of the steel core, as well as the degree of magnetic saturation reached in the cycle of magnetization.

The article by Prof. Waldo V. Lyon in this issue points out a relation that is not generally known for finding the harmonic components in a transformer primary current when the cyclic hysteresis loop of the steel core is given instead of an oscillogram. The problem is capable of being solved even when the impressed primary emf. is non-sinusoidal but has a definitely known wave form. The solution of the problem is, however, rendered much easier if the primary impressed emf. may safely be regarded as sinusoidal. Then, because a sinusoidal emf. can only be generated by a sinusoidal inducing magnetic flux, the phase of the excitation at each and every point of a properly drawn hysteresis loop becomes determined. The article shows that, after selecting eight suitable points on the curve, it becomes readily possible to compute the magnetizing forces in a Fourier series up to and including the seventh harmonic. It is interesting to notice the remark that the components in phase with the magnetization depend only on the co-ordinates of the mean magnetization curve, whereas the quadrature components depend only on the breadth of the hysteresis loop. Consequently, an indefinitely thin hysteresis loop betokens only inphase magnetizing components, whereas a wide and adipose loop rejoices in the possession of quadrature components. In all cases, as soon as the Fourier magnetizing components are known the corresponding exciting-current components, being severally proportional thereto, are readily deduced.

The disclosures in the article lead to the inference that valuable magnetic data might be obtained by measuring the hysteretic properties of a given transformer core, and also by securing oscillograms of the excitation current obtained from impressed sinusoidal emfs. of observed frequency and magnitude. A comparison between the Fourier series obtained by these two series of observations might evolve some interesting results. The method presented deserves careful study.

Standardizing Outdoor Substations

IN THESE days when the costs of labor and material are running to formidable figures the outdoor substation is coming into its own. We have over and over again commented on the change of practice in this respect, and we wish now once more to emphasize the importance of the matter from the purely practical standpoint of economics. The work of the Southern Illinois Light & Power Company along this line is especially important because it has reduced the designs to unusual simplicity of construction and to standard forms which promise well in the regular hard service of a distribution system. The two designs shown in the article on another page are for an ordinary two-pole station for a capacity of 150 kw. and below and for a four-pole type for heavier work. The practical point of the matter is that a two-pole station can be built without the transformers for less than $800, and a four-pole station for less than $1,800. The high-tension switching structure installed in connection with each cost less than $400. The meaning of this is that a substantial and permanent switching station and substation can be put up at a cost very moderate compared with that of the ordinary well-housed plant still widely used; that it will give equally good service, and that because of its low cost it will enable customers to be taken on in places where the cost of a building might prove, if not prohibitive, at least a serious matter in figuring the expense.

By thus standardizing the structure the labor of erection as well as the cost is in a very great degree economized. The figures are high compared with what would have been possible three or four years ago, but with the present costs of material and labor in building operations the estimates speak for themselves as to the desirability of carrying out work in this simple way. Time was when outdoor substations were looked at askance and generally considered desirable only for very mild climates. Experience has taught their more general applicability, and the data before us sufficiently emphasize their practical advantages.

The Coming Issues

AMONG the articles which will be contained in the next issue of the ELECTRICAL WORLD will be one on the advantages of electrified rolling mills, which will dwell on the considerations necessary in applying motor drive, comparative costs, and useful information on power costs. The fourth installment of Prof. C. E. Clewell's industrial series will discuss the attitude of machine tool builders to motor drive. In addition there will be special articles concerning the commercial side of the industry, besides the regular departments devoted to technical, operating, central station and market news and current happenings.

Distribution of Electric Power in Factories

Discussion of the Usual Practice in Distributing Energy, with a Consideration of the Effects of Changing Locations of Motors and the Value of Wiring Charts

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—In this article the author points out the fundamental importance of distribution circuits as the link between the power plant and the machines used for manufacture. Methods of preparing and using charts for keeping an accurate and up-to-date record of factory circuits, and of all changes which may be made on the circuits from time to time due to rearrangements in machinery and other causes, are discussed in connection with the advantages of having such wiring diagrams available when plans must be made for the installation of new motor equipment. The importance of circuit standardization to the factory as well as to the motor manufacturer is brought out, and interrelations which may exist between lighting and motor loads on given circuits are cited. Attention is called to the care which must be exercised in a proper division of the total load on the various circuits. The wiring diagrams shown in this article are based on the practice of a large manufacturer and illustrate methods which have proved successful in handling this problem.

A NUMBER of practical problems arise in connection with the distribution circuits in the average factory which have a close relation with the general operating features of the motor equipment. It is the purpose in the following notes to discuss some of these problems, not so much from the viewpoint of the design and installation of the circuits in a new plant as from that of the existing establishment in which changes in the location of machinery are necessary from time to time and also in cases where extensions of the plant are brought about by the large demands of an increased volume of business.

In many older and smaller factories, and also in many cases of large plants which have been in service for a number of years, there will be found a direct-current generating and distribution system which was governed to some extent at least by the class of apparatus, whether lamps or motors or both, which was installed at the time the plant was constructed. It is not uncommon, moreover, to find in the older and larger factories the initial direct-current system operating for the supply of the motors and lamps in certain parts of the factory within a small radius of the power house, with the addition later on of alternating-current distribution as the plant develops and the distances between the power house and more remote buildings become too great for the economical use of a direct-current supply.

Furthermore, as an additional factor, the increasing use of the adjustable-speed direct-current motor has made necessary the use of direct-current supply circuits in many large plants even where the distance of motors away from the power house was or has become too great for the economical use of direct current throughout.

Such a case is illustrated in Fig. 1, the advantages of high-voltage distribution being attained between the power house and rather remote sections of the factory by using alternating-current circuits as the means for transmitting the power from the generating room to convenient load centers. Motor-generators or synchronous convertors or both are installed at the end of the alternating-current lines and from this point the lower direct-current and alternating-current voltages are distributed up and down the aisles within reasonable distances of these centers.

Even in such cases, however, it has sometimes been found desirable to supply direct-current circuits of, say, 500 volts directly from the power house, and particularly so when such special circuits involve a somewhat small element of the total power required by each section of the factory. Fig. 1, therefore, gives a good general idea of a more or less typical lay-out of circuits where both direct-current and alternating-current transmission have been found to work out successfully for sections somewhat remote from the center of gravity of the plant.

In its broader aspects the electric circuit, as the connecting link between the power plant and the motors of a factory, forms a most important part of the complete power problem, since it is largely through efficiency in electric power distribution that the use of the motor has received such widespread acceptance as a substitute for line shafts and belting.

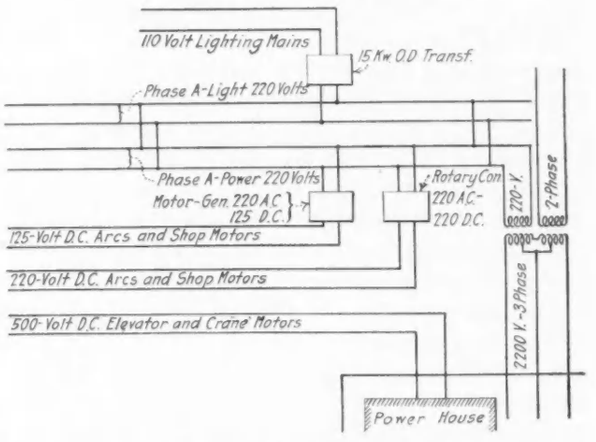


FIG. 1—SKELETON OUTLINE OF THE WIRING AS ARRANGED FOR ONE SECTION OF A GIVEN FACTORY

Notwithstanding the greatly superior characteristics of the electric circuit in contrast with mechanical power distribution, there is every reason from an engineering standpoint why the circuits in the average factory should receive the same care and attention in the everyday operation of the plant that is beginning to be recognized as essential for the successful operation of motor and lamp equipment.

Unfortunately, however, it is quite usual to find a marked degree of indifference in manufacturing concerns to the upkeep and general load conditions on the various component circuits which make up the entire distribution system, with the result that voltage and

power losses become excessive. Cases have occurred where some of the circuits in a given section were overtaxed while other circuits in the same section were either used very ineffectively or perhaps not loaded at all, owing to continual changes in motors from one part of the section to another and to the lack of any information concerning the amount of load on each circuit.

In instances of this kind not only do the lamps and

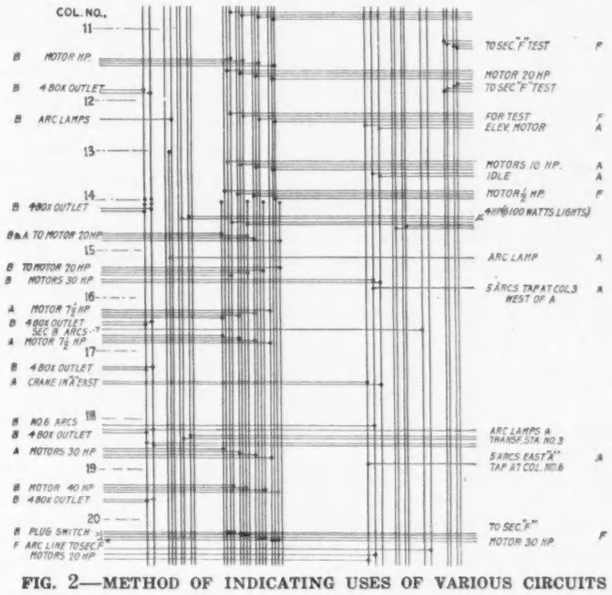


FIG. 2—METHOD OF INDICATING USES OF VARIOUS CIRCUITS

motors supplied by the overloaded circuits suffer by the low voltage due to the excessive voltage losses, but the power losses in the circuits become excessive and there is added the element of tying up the initial investment in long lines of copper which through oversight have become virtually non-producing as a part of the equipment.

Cases of just this kind are on record in practice, and as a remedy for the disadvantages of such a state of affairs the suggestion is here made that no factory should fail to provide as a part of its working records carefully prepared wiring diagrams of all existing circuits in such form that they may be available for everyday use in the changes which are sure to occur in practically every factory for both the lighting and power loads in the various sections of the plant.

Fortunately, there are some establishments which have realized the need for such accurate information concerning their circuits and which have taken steps to remedy the older haphazard method of making changes in the wiring. This makes it possible in the present article to describe briefly a typical case where the whole wiring situation has been worked out successfully.

An important point to note before describing this case is the fact that some plants, both large and small, have an electrician who has possibly been with the plant from its beginning and who knows or is supposed to know every circuit which has been installed. He may even resent the idea of placing on paper what he considers it his duty to carry in his head. However, the average electrician does not, nor is he able to, remember the changes in circuits which have been made over a period of years. If properly approached, he may be made to see that to reduce the wiring conditions to a definite set of diagrams not only serves to clarify the situation at the time of making changes in the wiring but that he is thereby saved much unnecessary care regarding the details of existing conditions.

It is, of course, a fairly simple and obvious matter to prepare such a map of all circuits in the new factory at the time of its construction, but as this article relates rather to older plants, the method now described will appeal to the latter rather than the former. Two general schemes are possible. One is to trace out and to reduce to a drawing all the circuits in a given section or on a given floor, with proper designations as to where each circuit comes from or where it goes and of all apparatus supplied from each tap. Such a diagram is shown in part in Fig. 2.

It may be stated that in this diagram the number and size of wires in each leg of the various circuits are indicated. Taps from these circuits are shown by lines up or down from the wires which extend along the aisle. Thus the load and its distribution along the circuit may readily be determined from the taps and the designations of the character of the load on each of the taps.

Where there are several bays in the same aisle a comprehensive idea of the circuit conditions throughout the entire section can be obtained by placing a number of diagrams like Fig. 2 end to end and studying the complete situation. This scheme is rather awk-

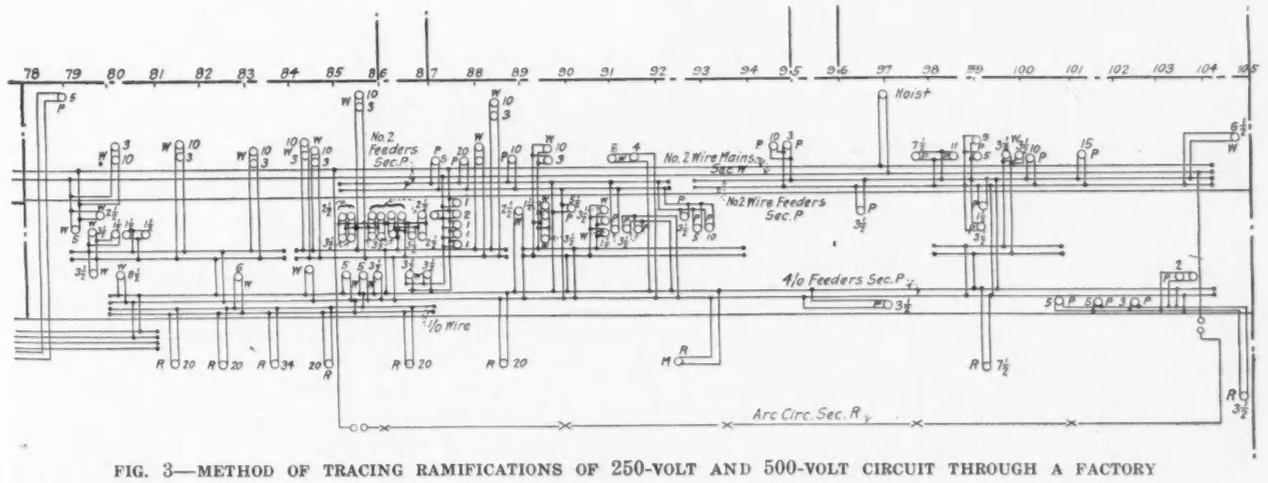

78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105
Hoist
No. 2 Feeders Sec. P
No. 2 Wire Mains
No. 2 Wire Feeders Sec. P
4/0 Feeders Sec. P
4/0 Wire
Arc Circ. Sec. R

FIG. 3—METHOD OF TRACING RAMIFICATIONS OF 250-VOLT AND 500-VOLT CIRCUIT THROUGH A FACTORY

ward, however, owing to the length of each chart and the much greater length when a number are placed end to end.

Another method which has thus found favor in actual practice is the plan of taking a circuit of a given type—for example, the 220-volt direct-current circuit—and following it completely throughout the plant with the idea of representing the conditions of this given circuit, or possibly of two similar circuits, in their entirety on a given single drawing. Two interesting cases of this kind are shown in part in Figs. 3 and 4.

In Fig. 3, for example, a portion of the layout of two of the direct-current circuits in a large plant is shown. In Fig. 4, by way of contrast, a somewhat similar diagram—that is to say, planned out according to the same method as that in Fig. 3—is shown, but the circuits are limited rather to centers of distribution than to the very general extensions shown by Fig. 3, being high-voltage alternating-current circuits.

Charts of this kind, when completed, may be kept up to date by simple notations of all changes on the tracings, from which frequent revised blueprints may be made for the every-day use of the wiring department. Therefore it becomes important in such cases to give special attention to the limitation of all the circuits to voltages and frequency corresponding to standard apparatus on the market. Moreover, the general character of the power plant and the problem of interchange of motors from one section to another is simplified if the circuits are kept down to fairly well-defined limits. This will obviously also simplify the purchase of new apparatus by affording relative ease in selecting standard types, provided the distribution system is planned with this end in view.

Another consideration, although perhaps a minor one in its relation to the motor problem, is the interrelation of lighting and power circuits. In some factories it may be the custom to use given circuits for both power and lighting. As a general rule these two services should be maintained on strictly separate circuits so that the lamps may be entirely free from voltage fluctuations, which are likely even on fairly well-designed power lines. It will be found desirable usually to employ the same methods of reducing the circuit conditions to a chart basis for the lighting service as for power service, since changes in the former are

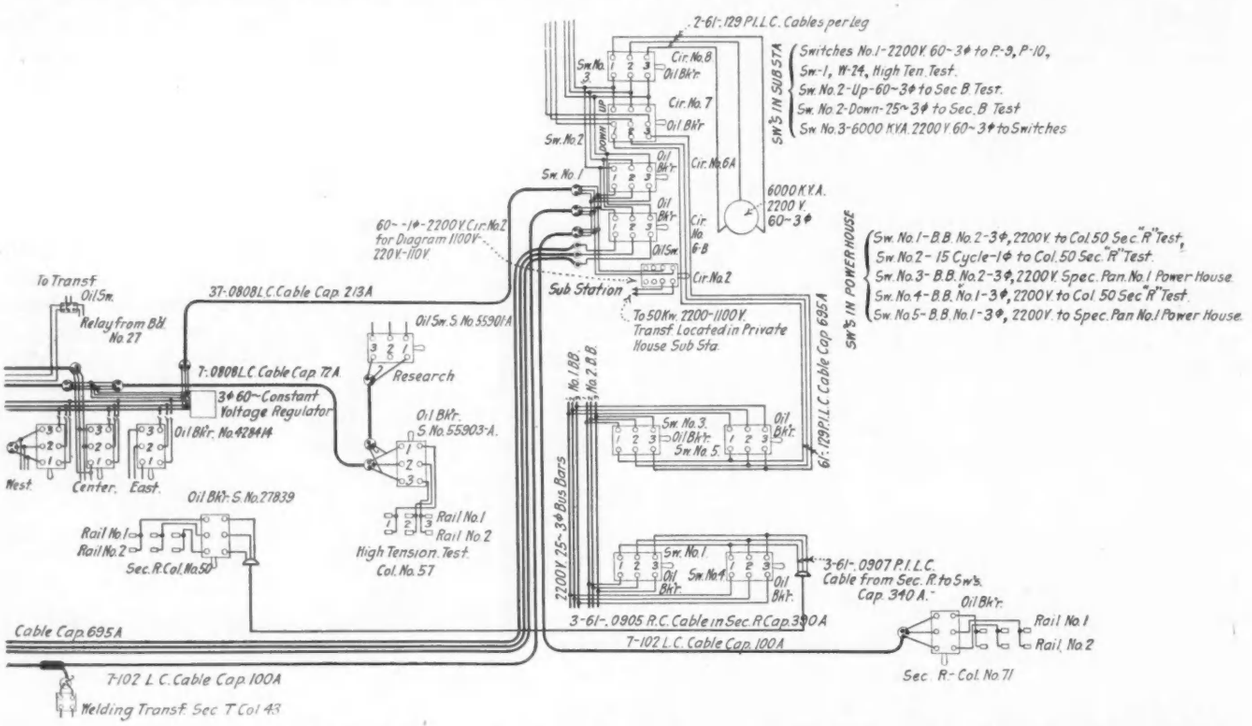

2-61-.129 P.L.L.C. Cables per leg
SW'S IN SUB STA
Switches No.1-2200 V. 60~3φ to P-9, P-10,
Sw-1, W-24, High Ten. Test.
Sw. No.2-Up-60~3φ to Sec. B Test.
Sw. No.2-Down-25~3φ to Sec. B Test
Sw. No.3-6000 K.V.A. 2200 V. 60~3φ to Switches
Sw. No.1
Sw. No.2
Cir. No.8
Cir. No.7
Cir. No.6A
Cir. No.6B
Cir. No.2
Oil Bkr.
6000 K.V.A.
2200 V.
60~3φ
Sub Station
60~-1φ-2200 V. Cir. No.2 for Diagram 1100V-220V-110V
To 50 Kw. 2200-1100 V. Transf. Located in Private House Sub Sta.
SW'S IN POWER HOUSE
Sw. No.1-B.B. No.2-3φ, 2200 V. to Col. 50 Sec. "R" Test,
Sw. No.2-15 Cycle-1φ to Col. 50 Sec. "R" Test.
Sw. No.3-B.B. No.2-3φ, 2200 V. Spec. Pan. No.1 Power House.
Sw. No.4-B.B. No.1-3φ, 2200 V. to Col. 50 Sec. "R" Test.
Sw. No.5-B.B. No.1-3φ, 2200 V. to Spec. Pan No.1 Power House.
To Transf.
Oil Sw.
Relay from Bd. No. 27
37-0808 L.C. Cable Cap. 213A
Oil Sw. S. No. 55901A
Research
7-0808 L.C. Cable Cap. 72A
3φ 60~Constant Voltage Regulator
Oil Bkr. No. 428414
Oil Bkr. S. No. 55903-A.
West
Center
East
Oil Bkr. S. No. 27839
Rail No.1
Rail No.2
Sec. R. Col. No. 50
High Tension Test. Col. No. 57
No. 1 B.B. No. 2 B.B.
Sw. No. 3.
Sw. No. 5.
6-129 P.L.L.C. Cable Cap 685A
2200 V. 25~3φ Bus Bars
Sw. No. 1
Sw. No. 4
3-61-.0907 P.L.L.C. Cable from Sec. R. to Sw's. Cap. 340 A.
3-61-.0905 R.C. Cable in Sec. R Cap. 390A
7-102 L.C. Cable Cap. 100A
Cable Cap. 695A
7-102 L.C. Cable Cap. 100A
Welding Transf. Sec. T Col. 43
Sec. R-Col. No. 71

FIG. 4—IN CONTRAST TO FIG. 3, THIS DIAGRAM SHOWS METHOD OF INDICATING RAMIFICATIONS OF A PARTICULAR TYPE OF CIRCUIT

It then becomes a simple matter to refer to these charts whenever a change is contemplated and to make such a change in keeping with actual rather than supposed load conditions on the various possible circuits to which such changes may apply.

IMPORTANCE OF STANDARDIZATION

It will, of course, be recognized that the voltages and general nature of the circuits in any factory depend to a large extent on those of the generating equipment and also upon the types of motors and lamps employed. However, in old plants there is a tendency to install too large a variety of circuits because of the addition of equipment at widely separated intervals of time. likely although they may not be so frequent nor on so large a scale as the latter.

In conclusion it may be stated that a systematic plan of keeping a record of all distribution circuits, as outlined above, has been found in practice to involve some slight expense, especially in an old and large plant where it is rather difficult to trace out individual circuits on account of mechanical difficulties in getting at the wires in some cases. After the initial lay-out has been made it is not difficult to keep it up to date if the process is carried out systematically. The expense should usually be far more than offset by the advantages of having these tangible records available as a working guide for the electrical department.

Obtaining Approximate Values of Harmonics

Simple Method Which Is Based Chiefly on Shape of Hysteresis Loop—Applicable to Sinusoidal or Non-Sinusoidal Impressed Voltages but Most Accurate for Former

BY WALDO V. LYON
Massachusetts Institute of Technology

A KNOWLEDGE of even the approximate magnitudes of the harmonics present in the no-load current of a transformer operating under specific conditions is often desirable. These harmonics are due to the cyclic variation in the permeability of the magnetic circuit. Unfortunately there is no exact method of solving the general case in which the electric "constants" of a circuit are variable. Any harmonic in the voltage can of itself produce no harmonic in the current of a lower frequency. If, however, it acts in conjunction with another harmonic of lower frequency, it will modify the harmonic of this frequency that would otherwise be produced. It is thus impossible to solve for the effects of the separate harmonics as if they acted alone and then to combine the results, as is done when the electric "constants" are not variable.

Apart from the circuit conditions outside the transformer, the magnitudes of the harmonics depend almost entirely upon the shape of the hysteresis loop. Ordinarily eddy currents and the resistance of the coils play but a small part in determining them. Both of these effects will be neglected in the following calculation. In the method that is developed here the coefficients of the approximate current curve are chosen so that it intersects the true curve at eight points in each half cycle. The points chosen are when $\omega t = 0$, 30 deg., 45 deg., 60 deg., 90 deg., 300 deg., 315 deg. and 330 deg. It is, of course, not so accurate as a Fourier analysis, which uses a greater number of points than this, but it possesses the advantage of being less laborious.

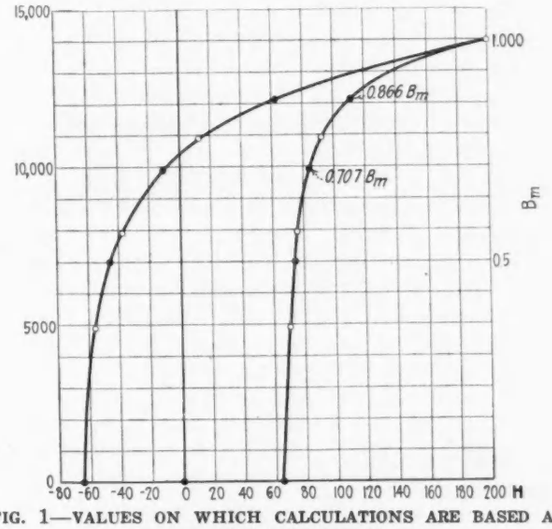


FIG. 1—VALUES ON WHICH CALCULATIONS ARE BASED ARE TAKEN FROM HYSTERESIS LOOP

If the sinusoidal voltage that is impressed on the transformer is

$$e = \sqrt{2}E \sin \omega t, \qquad (1)$$

the flux in the core is

$$\varphi = \varphi_m \cos \omega t. \qquad (2)$$

The maximum flux density in the core for this case is

$$B_m = \frac{0.225E10^8}{NfA} \quad \text{lines per sq. cm.,} \qquad (3)$$

where N, f and A are respectively the number of turns in the coil, the frequency of the applied voltage and the cross-section of the core in square centimeters. The hysteresis loop for this quality of iron, shown in Fig. 1, is drawn for this maximum flux density. A higher density than is used in practice is taken in order to exaggerate the errors of the method.

Assume that the expression for the magnetizing force producing this flux variation is

$$\begin{aligned} h = {} & A \sin \omega t + B \cos \omega t, \\ & + C \sin 3\omega t + D \cos 3\omega t, \\ & + E \sin 5\omega t + F \cos 5\omega t, \\ & + G \sin 7\omega t + H \cos 7\omega t. \end{aligned} \qquad (4)$$

Harmonics above the seventh are of little account. The magnetizing current taken by the transformer is

$$I_\varphi = \frac{0.796\, lh}{N},$$

where l is the length of the transformer core in centimeters and N is the number of turns in the winding. The effect of eddy currents is to increase the coefficient A, in some cases as much as 25 per cent. This increase is $2\sqrt{2}P10^7/fB_m$, where P, f and B_m are respectively the eddy current loss in watts per cubic centimeter, the frequency and the maximum flux density in lines per square centimeter.

In order to solve for the eight unknown coefficients, A to H, it is necessary to write eight equations. These are obtained by choosing eight points on the flux-variation curve (Fig. 1) as follows:

$\omega t = 0$	$B_1 = B_m$
$= 30$ deg.	$B_2 = 0.866B_m$
$= 45$ deg.	$B_3 = 0.707B_m$
$= 60$ deg.	$B_4 = 0.5B_m$
$= 90$ deg.	$B_5 = 0$
$= 300$ deg.	$B_6 = 0.5B_m$
$= 315$ deg.	$B_7 = 0.707B_m$
$= 330$ deg.	$B_8 = 0.866B_m$

$$h = B + D + F + H = H_1,$$

$$= \frac{A}{2} + \frac{\sqrt{3}}{2}B + C + \frac{E}{2} - \frac{\sqrt{3}}{2}F - \frac{G}{2} - \frac{\sqrt{3}H}{2} = H_2,$$

$$= \frac{A}{\sqrt{2}} + \frac{B}{\sqrt{2}} + \frac{C}{\sqrt{2}} - \frac{D}{\sqrt{2}} - \frac{E}{\sqrt{2}} - \frac{F}{\sqrt{2}} - \frac{G}{\sqrt{2}} + \frac{H}{\sqrt{2}} = H_3,$$

$$= \frac{\sqrt{3}A}{2} + \frac{B}{2} - D - \frac{\sqrt{3}}{2}E + \frac{F}{2} + \frac{\sqrt{3}G}{2} + H = H_4,$$

$$= A - C + E - G = H_5,$$

$$= -\frac{\sqrt{3}A}{2} + \frac{B}{2} - D + \frac{\sqrt{3}}{2}E + \frac{F}{2} - \frac{\sqrt{3}G}{2} + \frac{H}{2} = H_6,$$

$$= -\frac{A}{\sqrt{2}} + \frac{B}{\sqrt{2}} - \frac{C}{\sqrt{2}} - \frac{D}{\sqrt{2}} + \frac{E}{\sqrt{2}} - \frac{F}{\sqrt{2}} + \frac{G}{\sqrt{2}} - \frac{H}{\sqrt{2}} = H_7,$$

$$= -\frac{A}{2} + \frac{\sqrt{3}}{2}B - C - \frac{E}{2} - \frac{\sqrt{3}}{2}F + \frac{G}{2} - \frac{\sqrt{3}}{2}H = H_8.$$

Solving these equations gives:

$A = -2M - N - R$, $B = 2S + T + V$,
$C = 2M - 2N$, $D = 2S - 2V$,
$E = -M - 2N + P$, $F = S - U + 2V$,
$G = M - N + P - R$, $H = S - T + U - V$.

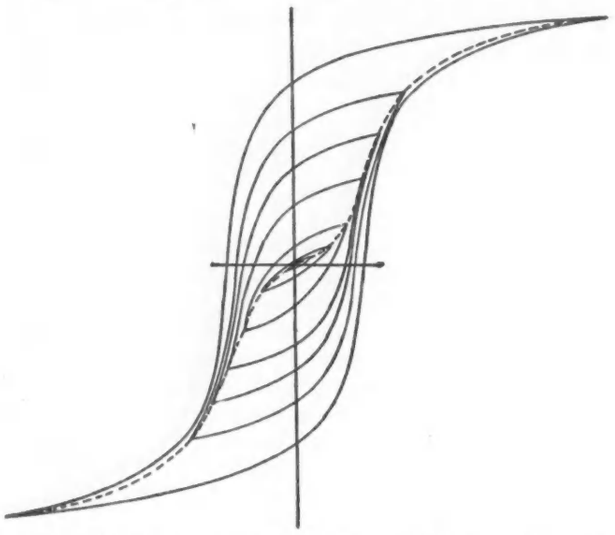


FIG. 2—COMPONENTS OF MAGNETIZING FORCE IN PHASE WITH FLUX DEPEND ON MEAN MAGNETIZATION CURVE, AND QUADRATURE COMPONENTS ON BREADTH OF LOOP

In which

$M = H_3/6$, $S = H_1/6$,
$N = (H_4 - H_2)/6$, $T = (H_8 + H_2)/2\sqrt{3}$,
$P = (H_7 - H_3)/2\sqrt{2}$, $U = (H_7 + H_3)/2\sqrt{2}$,
$R = (H_6 - H_4)/2\sqrt{3}$, $V = (H_6 + H_4)/6$.

Care must be taken to give the abscissae H_1 to H_8 their proper signs. M, N, P and R are proportional to the breadths of the hysteresis loop at the corresponding points. S, T, U and V are proportional to the abscissae of the mean magnetization curve at the corresponding points. Thus the components of the magnetizing force that are in phase with the flux depend only on the mean magnetization curve, while the components of the magnetizing force that are in quadrature with the flux depend only on the breadth of the hysteresis loop.

The mean magnetization curve, however, is not the normal saturation curve of the iron. The latter is the locus (Fig. 2) of the tips of the successive hysteresis loops taken with a constantly increasing maximum flux density. The magnitudes of the harmonics calculated from these two curves would, of course, be different. Thus hysteresis not only produces quadrature components in the magnetizing force, but also modifies the harmonics that would exist for a cyclic variation in the permeability that is determined solely by the normal saturation curve.

From the hysteresis loop (Fig. 1),

$\omega t = 0$	$B_1 = 14{,}000$,	$H_1 = 199$,	$M = 10.75$,
$= 30$ deg.	$B_2 = 12{,}120$,	$H_2 = 62$,	$N = 8.17$,
$= 45$ deg.	$B_3 = 9900$,	$H_3 = -11$,	$P = 33.4$,
$= 60$ deg.	$B_4 = 7000$,	$H_4 = -46$,	$R = 34.5$,
$= 90$ deg.	$B_5 = 0$,	$H_5 = -64.5$,	$S = 33.2$,
$= 300$ deg.	$B_6 = 7000$,	$H_6 = 73.5$,	$T = 50.0$,
$= 315$ deg.	$B_7 = 9900$,	$H_7 = 83.5$,	$U = 25.6$,
$= 330$ deg.	$B_8 = 12{,}120$,	$H_8 = 111$,	$V = 4.6$.

These points are marked by solid circles. Solving for the coefficients gives:

$A = -64.2$, $E = 6.3$,
$B = 121$, $F = 16.8$,
$C = 5.2$, $G = 1.5$,
$D = 57.2$, $H = 4.2$.

Therefore the equation of the magnetizing force is

$$h = -64.2 \sin \omega t + 121 \cos \omega t, + 5.2 \sin 3\omega t + 57.2 \cos 3\omega t, + 6.3 \sin 5\omega t, + 16.8 \cos 5\omega t, + 1.5 \sin 7\omega t + 4.2 \cos 7\omega t. \quad (5)$$

Owing to the high saturation the third harmonic is abnormally large, being 42 per cent of the fundamental.

It is interesting to note that it required but sixteen minutes to compute the coefficients as given in equation (5). The average error in this equation computed at twelve points 10 deg. apart, not including those used in the original calculations, is only 1.5. The errors are about equally divided between plus and minus.

NON-HARMONIC IMPRESSED VOLTAGE

The method just outlined can also be used when the impressed voltage contains harmonics, provided their magnitude and phase are such that the time variation of the flux has but one maximum value during each half cycle. If there is more than one maximum value, the hysteresis curve contains interior loops. The term "maximum value" here indicates a mathematical maximum, *i.e.*, $d\varphi/dt = 0$ and $d^2\varphi/dt^2 < 0$. Fig. 3 shows such a flux variation with maximum values at a and b. Since the voltage is zero whenever the flux variation is zero, only cases will be considered in which the voltage wave crosses the axis but once in each half cycle.

The determination of the maximum value of the flux density for which to draw the hysteresis loop may present some difficulty.

$$B_m = E_{av.} 10^8 / 4NfA. \quad (6)$$

$E_{av.}$ is the average value of the impressed voltage and B_m, N, f and A are as in equation (3). If the harmonics are not all in phase with the fundamental, the simplest method of finding when the voltage wave crosses the axis is to plot it. If, for example, the voltage is zero when $\omega t = \alpha$, its average value is

$$E_{av.} = \frac{1}{\pi} \int_{a}^{\alpha + \pi} e d(\omega t)$$

The integration might be performed with a planimeter.

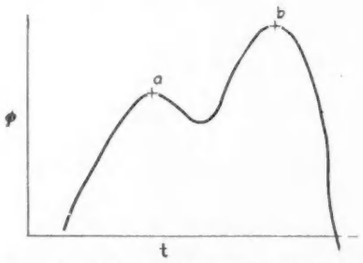


FIG. 3—FLUX VARIATION CURVE, INDICATING HYSTERESIS CURVE WITH INTERIOR LOOPS

If the harmonics are all in phase with the fundamental, the average value of the voltage is

$$E_{av.} = 2\sqrt{2} \left[(E_1 \pm (E_3/3) \pm (E_5/5) \right] \pi,$$

where E_1, E_3, E_5, etc., are the effective values of the harmonics. The plus signs are used when the harmonics are in phase and the minus signs when they are in opposition to the fundamental.

As an illustration of the method consider the simple case in which the impressed voltage is

$$e = \sqrt{2}E_1 \sin \omega t + \sqrt{2}E_3 \sin 3\omega t,$$

where $E_3 = E_1/3$.

The average value of this voltage is

$$E_{av.} = 2\sqrt{2}[E_1 + (E_1/9)]/\pi = E_1.$$

The maximum flux density by equation (6) is

$$B_m = E_1 10^8/4NfA.$$

Let the hysteresis loop, shown in Fig. 1, be drawn for this maximum flux density. For the impressed voltage considered the time variation of the flux is $\varphi = \varphi_1 \cos \omega t + \varphi_3 \cos 3\omega t$, in which $\varphi_3 = 1/9\varphi_1$ and $B = 0.9B_m \cos \omega t + 0.1B_m \cos 3\omega t$.

The maximum value of the flux density in Fig. 1 is 14,000 lines per square centimeter, while the values of the flux and magnetizing force at other points (marked by circles) on the hysteresis loop are:

$\omega t = 0$	$B_1 = 14{,}000$,	$H_1 = 199$,
$= 30$	$B_2 = 10{,}910$,	$H_2 = 13.1$,
$= 45$	$B_3 = 7920$,	$H_3 = -37.7$,
$= 60$	$B_4 = 4800$,	$H_4 = -56.0$,
$= 90$	$B_5 = 0$,	$H_5 = -64.5$,
$= 300$	$B_6 = 4800$,	$H_6 = 70.0$,
$= 315$	$B_7 = 7920$,	$H_7 = 75.5$,
$= 330$	$B_8 = 10{,}910$,	$H_8 = 92$.

By solving simultaneous equations for the coefficients A, B, C, etc., as before, the following equation of the magnetizing force can be written:

$$\begin{aligned} h = & -71.1 \sin \omega t + 99 \cos \omega t \\ & - 4.8 \sin 3\omega t + 61.8 \cos 3\omega t \\ & + 2.9 \sin 5\omega t + 24.4 \cos 5\omega t \\ & + 1.2 \sin 7\omega t + 14 \cos 7\omega t \end{aligned}$$

The third harmonic is now 51 per cent of the fundamental and both the fifth and seventh are considerably increased.

If the phase relation of the third harmonic is reversed so that the impressed voltage is peaked instead of being flat-topped, the equation of the magnetizing force becomes:

$$\begin{aligned} h = & -49.6 \sin \omega t + 176.2 \cos \omega t \\ & + 21.5 \sin 3\omega t + 44.2 \cos 3\omega t \\ & + 3.6 \sin 5\omega t - 12.7 \cos 5\omega t \\ & - 3.0 \sin 7\omega t - 8.5 \cos 7\omega t \end{aligned}$$

The accuracy of this method is not quite so good for these distorted voltage waves as it is for a sinusoidal one.

Boro-Silicon Glass

Fred M. Locke of Victor, N. Y., in patent No. 1,233,486, discloses an improvement on his boro-silicon glass, useful for high-tension insulators. The primary object of the invention is to produce an electrical insulator particularly adapted for conductors of high potential without the fusing temperature of the mass being raised to such an extent as to preclude economical production.

The following percentages of the mix are suggested:

	A	B	C
SiO_2	71	75	70
B_2O_3	28	15	13
Li_2O	1	1	9
Al_2O_3	..	5	2
Na_2O	..	4	..
Sb_2O_2	..	..	6

Among other things it has been discovered that the addition of a nitrate—as, for instance, nitrate of an alkali such as potassium nitrate or sodium nitrate—to the mix in manufacturing the insulator results in the production of a substantially pure-white transparent glass at lower fusion temperature.

ENGINEERING CHARGES IN CAPITAL ACCOUNT

Allocation Attacked in Boston Street-Lighting Case—City Contends Charges Should Be Made to Operating Expenses

An interesting discussion of the assignment of engineering charges to capital account formed part of the arguments in the Boston Edison street-lighting rate case heard recently by the Massachusetts Gas and Electric Light Commission. Corporation Counsel Sullivan of Boston maintained that the Edison company practice of carrying a permanent engineering force and charging the engineering payroll and incidental expenses to property account is open to grave objections. He held that it may be proper for a company in the early stages of development to charge engineering expenses to property account, but that when the plant has been developed, the company has become a successful going concern and the installation required from year to year can be estimated with reasonable accuracy, engineering should be charged to operating account.

"If extraordinary charges are incurred in any one year," said Mr. Sullivan, "they should be prorated over a period long enough to prevent operating charges from becoming excessive in any one year."

MAKING ENGINEERING A CAPITAL CHARGE

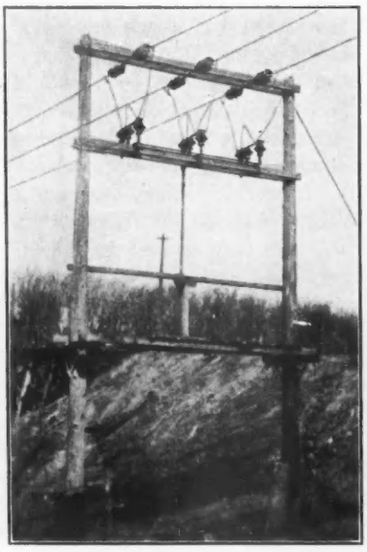
For the Edison company, F. M. Ives of its counsel, Burdett, Wardwell & Ives, Boston, asserted vigorously that payroll expenditures which enter into cost of property should be judged by the same standards and be subject to the same tests which are applied to the property itself, and that anything which contributes to cost of property is not a proper charge to be collected in full from the consumer if it be true that the utility's duty is to provide funds for financing the investment. Where cost of street lighting was computed on the basis of unit costs plus an allowance for engineering and incidentals, the city in every case excluded any allowance for engineering.

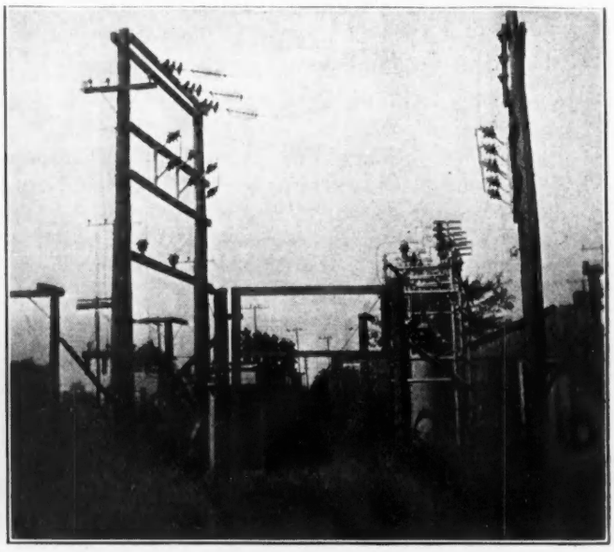
Engineering expenses alone in rapidly growing utilities of large size form a very substantial addition to the amounts which can be legitimately assigned as part of the cost of service. In the case of the Boston company engineering expenses have varied from about $125,000 to $235,000 a year in five years. Even these amounts could not have been added to operating expenses without reducing the amount available for return below a fair amount after providing for all necessary intervening payments. Even if this were not the case, it must be conceded that questions of this kind ought to be decided upon merits; and from the consumer's point of view the company is certain that if the rate was sufficiently high to permit such expenses to be charged to operating account, rates should be reduced rather than kept up for collection of this unjustifiable charge. The experience of utilities has shown that the road to lower rates for existing consumers does not lie in the direction of collecting part of the cost of plant from consumers, but in developing new fields of use which have not already been fully supplied, and that more can be accomplished by reducing rates where new business can be built up which will not only pay its own cost but will help to reduce cost of existing business than by any other known method.

Inexpensive 33,000-Volt Outdoor Substations

Two Designs Have Been Worked Out by an Illinois Company That Give Greater Simplicity in Construction and Permit Greater Ease in Making Repairs—Cost Data and Bill of Materials Given

THE Southern Illinois Light & Power Company of Hillsboro, Ill., has standardized on the two types of 33,000-volt outdoor substations shown in the accompanying drawings. The two-pole type shown in Fig. 6 is used on installations as large as 150 kw. and as small as 50 kw. The four-pole type shown in Fig. 2 is for larger installations. The idea back of the design in both types was to plan a station which would be simple to construct and easy to maintain without involving too great an investment. One of the things which assisted in working out such a station was the elimination of all specially made equipment and fittings. The material used in these stations is all standard line material with but one minor exception.

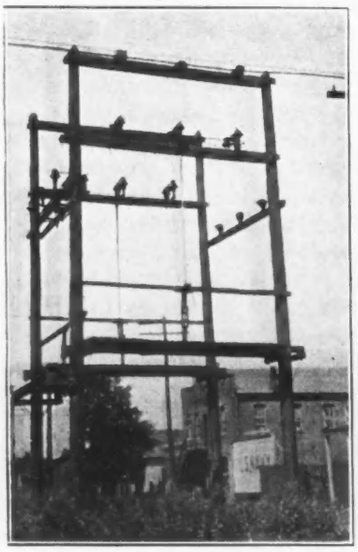


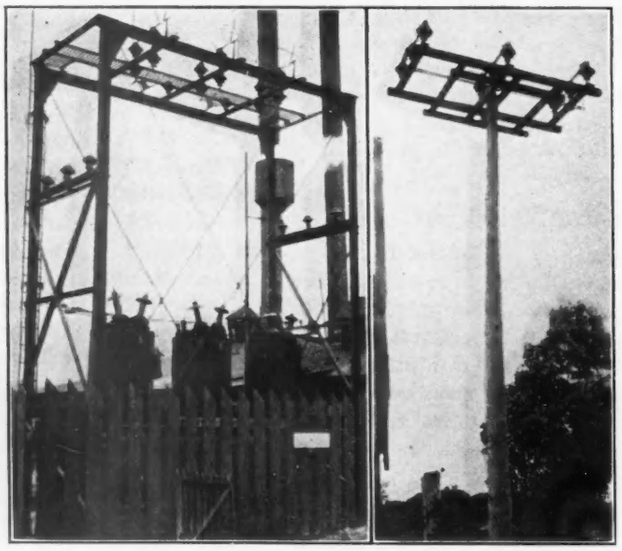


FIGS. 1 AND 2—TWO-POLE SWITCH STRUCTURE AND FOUR-POLE SUBSTATION, DETAILS OF WHICH ARE SHOWN IN FIGS. 7 AND 9 RESPECTIVELY

The two-pole station is used on either single-phase or three-phase installations where the investment must of necessity be limited and where the apparatus is of such small capacity that the installation of electrolytic lightning arresters is not justified. It is frequently used for serving small towns, but is seldom used at coal mines because there are usually enough empty buildings about a mine to house the equipment. This type of station requires a space approximately 21 ft. (6.4 m.) long and 10 ft. (3.04 m.) wide.

The transformers are set on a concrete base instead of being erected on a platform. The latter plan was formerly used, but it was learned that the extra weight on the structure shortened its life and that repair work was unnecessarily difficult and dangerous. The character and amount of material used in this station are shown in the bill for materials on page 954. No. 2 solid copper is used on all bus work and all connections for greater mechanical strength.



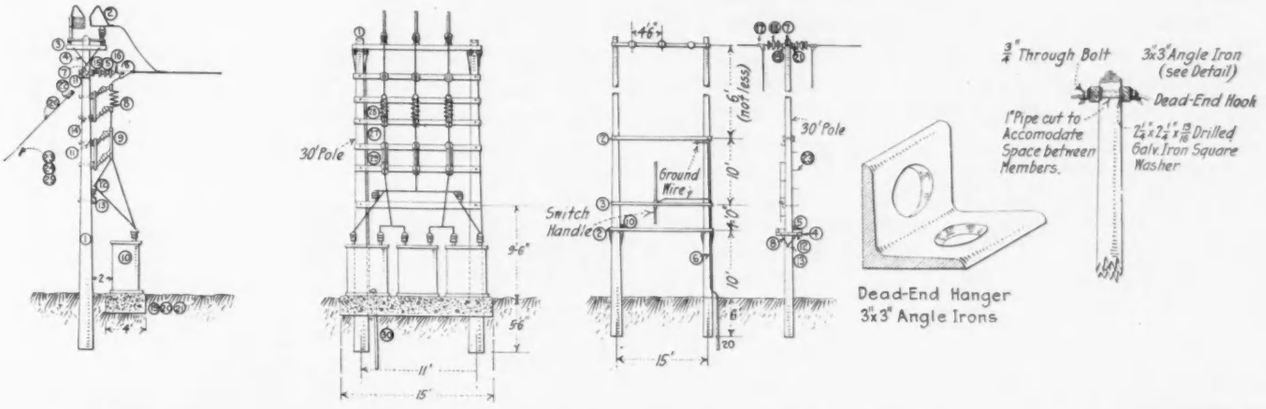


FIGS. 3, 4 AND 5—TWO OLDER TYPES OF FOUR-POLE SUBSTATIONS AND ONE-POLE SECTIONALIZING INSTALLATION

A detail drawing of a dead-end hanger is illustrated in Fig. 8. It is the one item which is not standard, being made of 3-in. by 3-in. (7.62-cm. by 7.62-cm.) angle iron. It was selected for this service because it eliminates the necessity of boring extra holes in the arms, it transmits the strain equally to both of the arms, and it saves eyebolts. The fittings cost 14 cents apiece.

The cost of a two-pole station of this type without transformers and without the switch structure, which is built separately as shown in Fig. 6, is $773. An itemized statement of this expense is given in Table I, below.

The four-pole type of station is used where the load serve such isolated industrial loads as coal mines if housing space were not available. The drawing and the bill of material give an adequate description of the station. It may be pointed out that the company at first used four-pin cross-arms in building the barbed-wire fence support because the arms were standard line



FIGS. 6, 7 AND 8—TWO-POLE TRANSFORMER STATION, TWO-POLE SECTIONALIZING STATION, AND DETAIL OF DEAD-END HANGER

TABLE I—ITEMIZED COST OF TWO-POLE SUBSTATION

Material	$424
Labor	100
Superintendence	10
Interest and miscellaneous contingencies	40
Freight and drayage	100
Ten per cent overhead	63
Five per cent engineering and purchasing charges	36
Total	$773

TABLE II—ITEMIZED COST OF FOUR-POLE SUBSTATION

Material	$1,219
Labor	110
Superintendence	75
Interest and miscellaneous contingencies	50
Freight and drayage	100
Ten per cent overhead	156
Five per cent engineering and purchasing charges	78
Total	$1,788

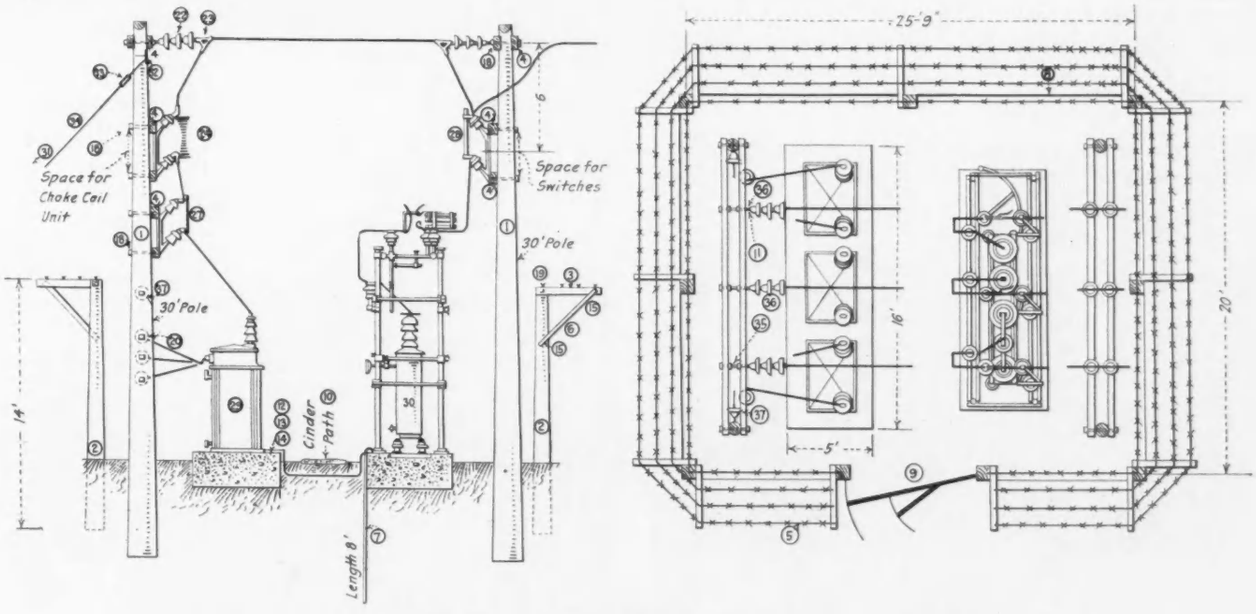


FIG. 9—ELEVATION AND PLAN OF FOUR-POLE SUBSTATION LIKE THAT SHOWN IN FIG. 2

and the character of the service required demand the use of electrolytic lightning arresters. The company has built this type of station in sizes ranging from 150 kw. to 500 kw., but there is no reason why the same design could not be employed for even larger stations. The installations which have been made to date serve towns, but stations of the same design could be used to equipment. It has been found cheaper, however, to employ 4-in. by 4-in. (10.16-cm. by 10.16-cm.) timbers. Square posts were selected for sightliness. Building a small gate within the larger one makes for convenience under ordinary operating conditions and also at times when equipment must be moved in or out. The same special dead-end fittings are used on this struc-

ture as on the two-pole type. The cost of this station without transformers and without the separate high-tension switching structure is $1,788. The costs are itemized in Table II.

Placed outside both of these types of station about one span distant is a two-pole high-tension switch structure. The detached location for this structure was chosen to afford plenty of clearance for working on the station dead. This same type of structure is also

BILL OF MATERIALS—FOUR-POLE STATION

Item	Quantity
POLE STRUCTURE	
1 30-ft. poles	4
4 4-in. by 6-in. hard pine	10
17 2¼-in. by 2¼-in. by 3/16-in. square washer	76
18 ¾-in. by 18-in. galvanized bolts	16
20 ¾-in. by 14-in. eye-bolts	6
31 ⅝-in. by 8-ft. anchor rods	2
32 Shim plates	4
33 Three-bolt clamp	4
34 ⅜-in. guy cable, ft	75
FOUNDATIONS, ETC.	
12 Portland cement, bag	44
13 Sand, cu. yd.	4½
14 Screened gravel, cu. yd.	11
10 Cinders, cu. yd.	2
FENCE	
2 14-ft. square posts	9
3 4-in. by 4-in, 3½-ft. yard post	13
5 Barbed wire, ft.	400
6 26-in. cross-arm brace	13
8 Galvanized square-mesh fencing	96
9 Gate	1
15 ½-in. by 4-in. lag bolts	13
16 ⅝-in. by 4½-in. carriage bolt	13
19 ¾-in. by 14-in. galvanized bolts	13
21 Staples	5
APPARATUS AND ACCESSORIES	
22 Ohio Brass strain disks	27
23 Ohio Brass dead-end clamps	6
24 Delta-Star type choke coil	3
27 Delta-Star fuse mount No. 8131	3
28 Delta-Star disk switch, type G	3
29 Westinghouse 200-kva., 33,000-volt to 2300-volt transformer	3
30 General Electric electrolytic arrester, type I	1
7 ¾-in. by 8-in. galvanized pipe	3
11 Angle-iron hanger	3
35 ⅝-in. by 18-in. space bolts	4
36 Ohio Brass insulation hooks	3
37 2300-volt strain insulator	6
38 S. C., No. 51	9

standard for sectionalizing the company's transmission lines. They are installed for such work at intervals of 5 miles or 6 miles (8 km. or 9.7 km.), except where substations are less than this distance apart. The bill of material for this structure without apparatus is

TABLE III—COST OF SWITCH STRUCTURE

Material	$224
Labor	50
Superintendence	5
Interest and miscellaneous contingencies	15
Freight and drayage	25
Ten per cent overhead	31
Five per cent engineering and purchasing charges	18
Total	$368

given herewith. The apparatus used in addition to that itemized list consists of a Burke disconnecting switch with separate cast pins. This latter feature is an improvement which makes it possible to change insulators without taking the switch down. It also does away with handling small parts which linemen are apt to drop and lose. The cost of this structure, including the switch, amounts to $368. The cost is itemized in Table III.

The stations of these types which the company has

BILL OF MATERIALS—TWO-POLE SWITCH STRUCTURE

Item	Quantity
1 Straight cedar poles	2
2 4-in. by 6-in. by 16-ft. hard pine (long-leaf)	6
3 4-in. by 4-in. by 16-ft. hard pine (long-leaf)	1
4 Standard two-pin cross-arms	4
5 2-in. by 4-in. by 4-ft. hard pine	25
6 1-in. half-round single groove molding, ft.	12
7 ¾-in. by 20-in. spacing bolts	3
8 26-in. standard cross-arm brace	8
9 ¾-in. by 18-in. galvanized bolts	8
10 ¾-in. by 12-in. galvanized bolts	8
11 2¼-in. by 2¼-in. by 3/16-in. square washers	56
12 ⅝-in. by 4½-in. carriage bolts	8
13 ½-in. by 4-in. lag screws	4
14 20-d wire nails, lb.	4
15 1-in. pipe straps	4
16 8-d wire nails, lb.	1/6
17 Ohio Brass dead-end clamp No. 6233	6
18 Ohio Brass strain disk No. 11,535	18
19 Dead-end angles	3
20 ¾-in. by 9-ft. galvanized-iron pipe	1
21 Ohio Brass hooks	6
22 No. 2 B. & S. gage copper wire, ft.	50
23 Galvanized pole steps	11

built are proving satisfactory. Practically the only important change in the first design consisted of employing strain-type insulators on the poles near the lightning arresters (Fig. 9) instead of the pin-type insulators which were first selected.

The outdoor substations described here were de-

BILL OF MATERIALS—TWO-POLE STRUCTURE

Item	Quantity
1 Straight cedar poles	2
2 Schweitzer & Conrad or Burke sphere-gap arrester	3
3 Standard 4-ft. cross-arm	4
4 26-in. cross-arm braces	8
5 Victor insulator No. 2335A or Ohio Brass No. 4535	9
6 Ohio Brass clamps No. 6233	3
7 ¾-in. by 18-in. spacing bolts	3
8 Delta-Star type G choke coil	3
9 Delta-Star type G fuse mount	3
10 Transformers	3
11 4-in. by 6-in. by 12-ft. hard pine	9
12 Thomas insulator No. 3058 or Locke No. 3512	2
13 Electric Service Supplies Co. iron pin No. 163	2
14 ¾-in. by 18-in. galvanized bolts	4
15 Locke or Ohio Brass attachments	3
16 Locke or Ohio Brass attachments	3
17 ⅜-in. by 4½-in. carriage bolts	8
18 ½-in. by 4-in. lag bolts	4
19 Portland cement, bag	27
20 Sand, cu. yd.	2
21 Screened gravel	5
22 Three-bolt guy clamp	4
23 Guy thimbles	4
24 6-in. anchor rods	2
25 3-in. by 3-in. anchor washers	2
26 ⅜-in. galvanized guy cable, ft.	75
27 Ground molding, ft.	24
28 1-in. pipe straps	12
29 Upper ground cable, ft.	40
30 ¾-in. by 8-ft. ground pipe	1
31 No. 2 B. & S. gage solid copper wire, ft.	60
32 ½-in. by 7-in. machine bolts	18
33 2¼-in. by 2¼-in. square washers	42
34 Schweitzer & Conrad No. 51A	3
35 Washers placed under each through-bolt head and nut.	

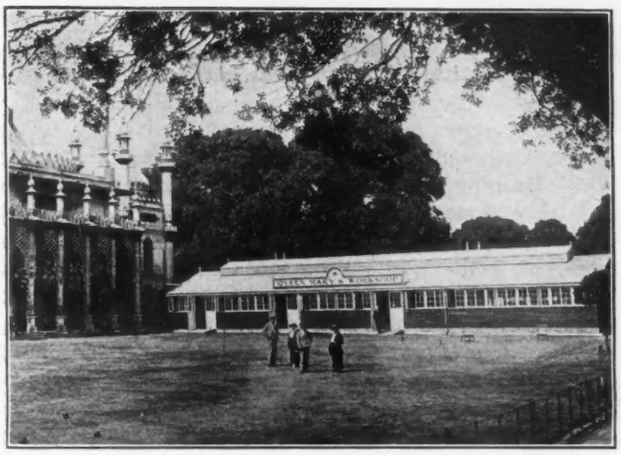
signed under the direction of W. F. Corl, general superintendent of the Southern Illinois Light & Power Company.

Electrical Training for Crippled Soldiers

Work Done in England to Fit Workers for Service in Electrical Industries—Public Duty to Provide a Chance of Employment a Little Better than the Average

BY DOUGLAS C. McMURTRIE*

ELECTRICAL work in its various branches is proving a popular way in which to train soldiers crippled in the present war. It is one of the leading subjects of instruction at Queen Mary's Hospital, Roehampton, England, where there are at any one time



WORKSHOP AT PAVILION MILITARY HOSPITAL, BRIGHTON

hundreds of men with amputated limbs awaiting the fitting of artificial arms and legs and being meanwhile prepared for return to civil life—independent and self-supporting.

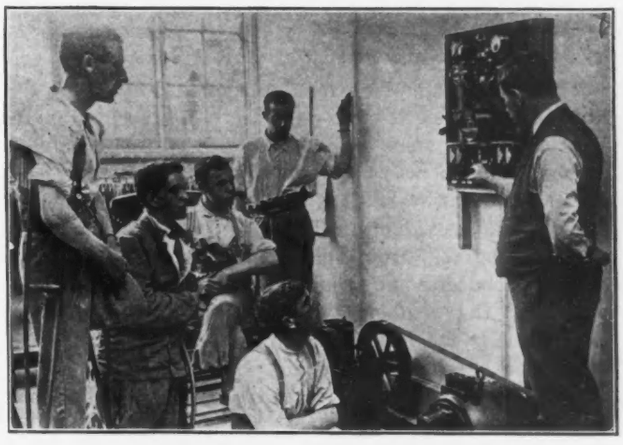
At the Pavilion Military Hospital, Brighton, there are likewise electrical classes, carried on in Queen Mary's Workshop, operated in conjunction with this center for the care of limbless soldiers. There is provided instruction preparatory to various openings which call for a knowledge of electrical machines, lighting, telephones and bell systems. The men are trained as electrical assistants and for attendants in private houses, theaters, hotels, business houses, workshops. mills, coal mines and so forth. There is also a special course to enable men to qualify as switchboard attendants at electric power stations.

The Institution of Electrical Engineers, in co-operation with the London public educational authorities, has organized classes for training disabled soldiers and sailors as electrical substation attendants. The instruction is given at the Northampton Polytechnic Institute. Up to the present time 150 men have completed the course. The instruction comprises workshop practice in wiring and the use of simple tools, power-house demonstrations, electrical and physical laboratory work, class demonstrations in the elements of electrical engineering and of simple engineering physics, the writing of reports on demonstrations and laboratory work, and, in conclusion, an oral examination.

At the Regent Street Polytechnic in London there are courses of a similar nature. Here are received for more advanced training men who have done preliminary work in the hospital at Roehampton. The men are first instructed in general electrical work and then passed on to the London United Tramways for experience in generating plant and substation practice. This course takes from two to three months.

At the Battersea Polytechnic in London the principal says that the second most popular course offered to crippled soldiers is that in electrical testing or switchboard work. "We have trained successfully men suffering from shell shock and nervous trouble, together with other types of disablement. A fair education is required for this work, together with ability to do simple calculations. For this work we do not mind taking men who have only partial use of an arm or hand, as it often happens that the fuller use of the arm is simply a matter of time. We do not, however, care to take those who have actually lost an arm, and we would rather not have them if they have lost a leg, although the latter is not so important as the former. We have been able to place all the men who have been through this work, and the firms are willing to take other men when they become ready for work. We think this work offers reasonable wages and conditions."

The Fife Mining School, Cowdenbeath, England, conducts a course for electric motor and switchboard operatives. Some of the men are preparing to be underground motor attendants in the mines; in these cases



UNFOLDING MYSTERIES OF DYNAMO AND SWITCHBOARD TO EAGER PUPILS

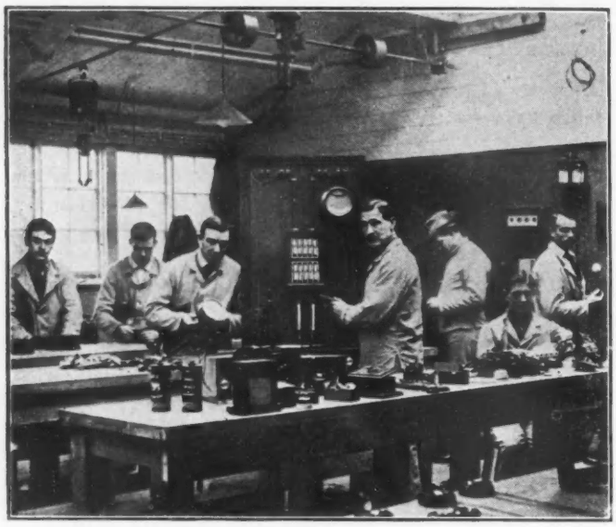
their electrical training is supplemented by preparation for a mine fireman's certificate.

A communication from the director of the school gives the following syllabus of the course:

What happens when an electric current passes in a conductor. Heating, glowing and fusing of a wire carrying a current. Use of fuses. Tests with fuse wires. Replacement of fuses.

*President of the Federation of Associations for Cripples, editor of the *American Journal of Care for Cripples*, and acting director of the Red Cross Institute for Crippled Soldiers and Sailors.

Resistances and their use in controlling currents. Measurement of electrical currents and pressures. Elementary notions of the construction of ammeters and voltmeters. Range of the instruments. Precautions to be observed in their use. Conductors and insulators. Insulated conductors of various types. Arrangement of conductors in series and in parallel circuits. Uses of porcelain, rubber, paper, slate,



ELECTRICAL WIRING AND TESTING, ROEHAMPTON

marble, etc., as insulators. Jointing. Construction and use of blow lamp and soldering iron. Making of married and T joints on conductors. Sweating of joints, thimbles and connectors. Switches of various types and their use in the control of electricity.

Motor starters and their care and proper usage.

Trip devices. General arrangements of a switchboard.

Testing. Use of test lamp and detector for sorting out circuits. Pole finding.

Electric bells and indicators.

General idea of a direct-current generator.

General idea of direct-current motors.

General idea of the construction and use of a battery of accumulators, and of how it should be cared for.

Practical exercises in operating direct-current generators and motors and in charging a battery. Some simple notions of alternating-current generators and motors and on the synchronizing of two alternating-current generators.

The conception of national responsibility to the disabled soldier, not only to pay him a pension but to re-educate him in some trade which he can follow in spite of his handicap, was recognized for the first time early in the European war. It is now realized that the cripple, while perhaps unable to take up again his former trade, is not debarred from all occupation. The effort is always to select some trade related to the former occupation of the disabled man; in this way his former experience is not lost. A competent journeyman bricklayer who has lost an arm may be prepared by a suitable course in architectural drafting and the interpretation of plans to take a position as construction foreman of a bricklaying gang. It would be idle to give such a man a course in telegraphy. But a train hand who has been all his life familiar with railroad work may most wisely be trained as a telegraphic operator, with a little commercial instruction on the side.

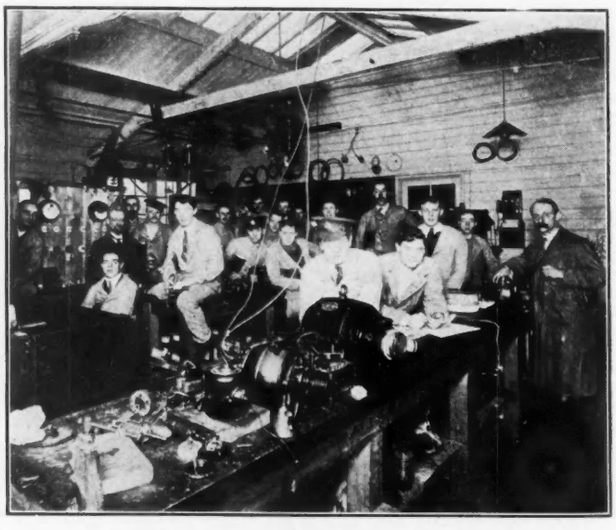
Instruction is of little value if it is not thorough. Nothing could be more unfortunate either for the individual soldier or for the cause of crippled men in general than to turn out into any trade classes of half-trained men. Courses should be too long rather than too short. When preparation is defective it makes for bitter discouragement on the part of the workman and distrust of the training system on the part of the employers. Men disabled in the national service deserve the very best provision which the country can organize for them.

The authorities responsible for re-educating disabled soldiers must depend very largely for advice and assistance upon representatives of both workers and employers in any line in which instruction is given. Those in the electrical trades in this country may expect to be called upon for co-operation when there are organized in the United States training schools for the crippled men of their own forces. The nation cannot go too far along the right lines. To give the crippled soldier the best of medical care, a good artificial limb, a first-rate training to fit him for a remunerative trade, and a chance of employment a little better than the average —these constitute the real public duty. A coddling attitude should be frowned upon as actually unpatriotic, the other promoted and encouraged.

The first country to make adequate provision for the trade-training of war cripples was France, where a school was started at Lyons a few months after the opening of hostilities. Now there are hundreds of instruction centers in the various belligerent countries. Even Belgium has several schools to meet the needs of her disabled soldiers.

In Canada the work is national, being carried on by the federal government, which has established throughout the Dominion schools for war cripples.

American interest in the subject is growing daily. In New York there has been established the Red Cross Institute for Crippled Soldiers and Sailors, made possible by a gift of more than $50,000 from Jeremiah Milbank. Committees have been formed and plans for reconstruction centers are under way in Chicago, Boston and other cities. The Surgeon General's office of the



ELECTRICAL WORKSHOP, ROEHAMPTON

War Department has announced its intention to establish training centers in connection with the great base hospitals.

But it is on the enthusiastic support and assistance of thousands of individuals, expert in various lines, that must rest the ultimate success of reconstructing the crippled men of the national army.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

THE LINEAR EXPANSION OF COPPER BUSBARS

Chart Is Arranged for the Direct Determination of the Actual Expansion of a Bus Run Over Any Reasonable Change in Temperature

In a great many central stations and industrial plants the linear expansion of busbars with change of temperature has given rise to much difficulty. In some cases this displacement of busbars due to expansion has damaged the supporting insulators and in other cases it has destroyed the alignment of switches placed in immediate connection with the bus.

The accompanying chart is arranged for the direct determination of the actual expansion of a bus run of 100 ft. (30.5 m.) in length over any reasonable range of temperature established in either degrees Centigrade or

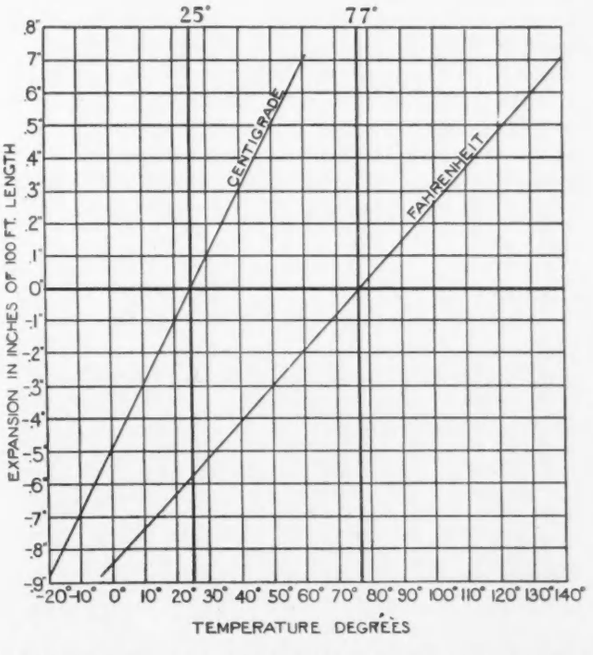


DIAGRAM OF LINEAR EXPANSION OF COPPER FOR DIFFERENT TEMPERATURES (FAHRENHEIT AND CENTIGRADE)

Fahrenheit. For simplicity the expansion is taken both ways from an assumed installation temperature of 25 deg. C. (77 deg. Fahr.), so that over all ordinary ranges the total expansion for 100 ft. (30.5 m.) of bus run will be the sum of the values shown above and below the installation length. For example, a 100-ft. (30.4-m.) length of bus on which the temperature might vary from 10 deg. C. to 55 deg. C. would contract 0.3 in. (7.5 mm.) below installation length at 10 deg. C. and expand 0.6 in. (15.5 mm.) over installation length at 55 deg. C., or, disregarding the installation entirely, would have a total change of length of 0.9 in. (23 mm.) over the temperature range chosen. Presentation of this information in such a simple form has been made possible through the co-operation of the Bureau of Standards in establishing the varying coefficient of expansion for copper, says the General Devices & Fittings Company, which contributed this chart.

Any damage to the insulators or nearby switches may be forestalled by the judicious relief of this bus travel by means of expansion joints. It should be noted that the expansion determined from the chart is the actual expansion and is somewhat greater than the expansion of the bar relative to the supporting structure. The supporting structure has generally less expansion over any range of temperature and is not subjected to such a wide variation of temperature as the busbar itself, nor does it respond so quickly, since the temperature variation is first in the room air and not in the building material itself.

SHUNT REACTORS OFFSET HIGH-CHARGING CURRENT

Method Suggested to Compensate for Currents of This Nature Experienced on Iowa Iron-Wire Transmission Lines

BY C. J. JONES

In the opinion of the writer, the most economical and practical way to compensate for the heavy charging current experienced on the iron-wire line of the Midland Water, Light & Ice Company, Dodge City, Iowa, and pointed out by M. D. Leslie in the Oct. 13 issue of the ELECTRICAL WORLD, is to connect iron-core reactors across the high-tension side of the transformers at the delivery end of the line. These should preferably be provided with taps so that the lagging current drawn from the line can be adjusted to compensate for changes in the charging current. Of course, the larger the number of taps on the line the greater will be the cost of the reactors.

Under the conditions named by Mr. Leslie, 22,000-volt reactors with 1-amp. and 2-amp. taps should be sufficient. The reactors could have air gaps in their cores and the iron should be magnetized at a reasonable flux density. When the charging current on the generators is 30 amp. (3 amp. on the 22,000-volt line) and the 2-amp. taps of the reactors are connected, the latter will draw 2 amp. lagging current while the line is drawing 3 amp. leading current, making the resultant current drawn from the generator 10 amp. (1 amp. at 22,000 volts) leading, in addition to that caused by line, transformer and reactor losses.

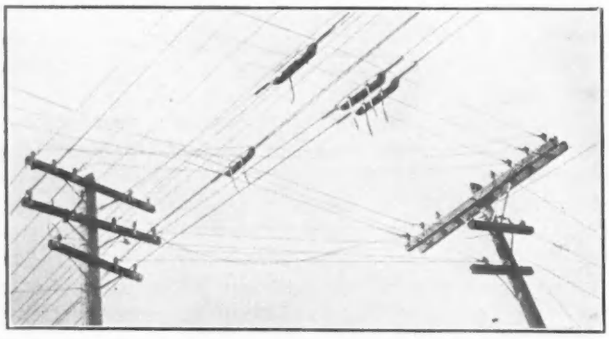
Another method of compensating for the charging current, one which is not quite so practical or economical as the foregoing, however, is the use of a specially constructed transformer taking a large exciting current.

LINEMEN'S SHIELDS ARE USEFUL IN EMERGENCIES

Interruption to Service Resulting from Accident Is Minimized by Separating Crossed Lines Temporarily with These Appliances

Linemen's shields may not only be used for the protection of workmen but will be found useful in emergencies to prevent crosses between lines.

In a recent automobile accident which occurred in the early evening a 40-ft. (12.2-m. pole was cut off



LINEMEN'S SHIELDS SEPARATE CROSSED WIRES TO MAINTAIN TEMPORARY SERVICE

4 ft. (1.2 m.) above the ground line, and the splintered butt dropped to the ground. The pole remained in approximately a vertical position, however, owing to the attached lines and guys, but the 2300-volt wires carried on the top cross-arm were lowered onto the secondary wires of a cross lead. In order to maintain service with safety until a new pole could be set on the following morning the repair foreman availed himself of a supply of linemen's shields, as shown in the photograph.

MEASURING THE WATER FOR BOILER-FEED USE

How an Accurate Method for Weighing Feed Water in a Very Limited Space Was Worked Out at Toledo

BY ALEX. W. MORGAN

In conducting tests in the boiler room of the Toledo Railways & Light Company it was found that owing to the lack of space the ordinary method of weighing the water could not be used. Moreover, the plant had no extra pump that could be used for test purposes only. A special method of measuring the water was therefore devised.

Knowing that an orifice will pass a given amount of water under a given head, and that the amount of water passed varies as the square root of the head, a measuring tube was designed using orifices the capacity of which had been determined by actually weighing the water passed through them in a given time.

The measuring tube consisted of two 5-ft. (1.5-m.) pieces of 12-in. (30.5-cm.) flanged pipe fastened end to end and suspended vertically. Between these flanges was inserted a circular piece of 1/16-in. (1.59-mm.) boiler-plate in which four ⅛-in. (2.86-cm.) orifices had been drilled. The centers of these orifices were on a circle which divided the cross-section of the pipe into equal areas.

Down the center of the pipe was placed a 2.5-in. (6.4-cm.) lead pipe connected with the water supply. The lower end of the 2.5-in. (6.4-cm.) pipe was capped and placed about 12 in. (30.5 cm.) above the orifice plate. A large number of ½-in. (1.3-cm.) holes were drilled in the lower end of the 2.5-in. (6.4-cm.) pipe to change the direction of flow of the water in order to reduce to a minimum any disturbance which the water entering

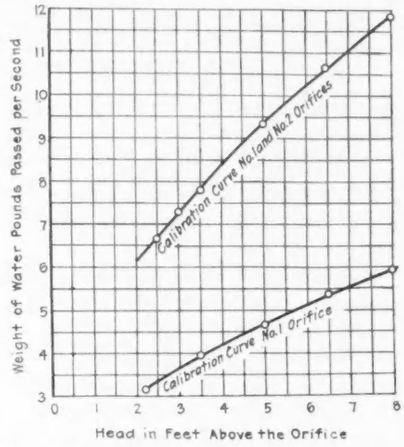

Weight of Water Pounds Passed per Second
Head in Feet Above the Orifice
Calibration Curve No.1 and No.2 Orifices
Calibration Curve No.1 Orifice

FIG. 1—METHOD OF PLOTTING CALIBRATION CURVES

might make and also to prevent the velocity head of the incoming water from exerting an influence upon the flow through the orifices. Gage glasses were attached to the outside of the 10-in. (25.4-cm.) pipe to indicate the head and a 2.5-in. (6.4-cm.) valve was placed in the water line to regulate the height of the incoming water in the 12-in. (30.5-cm.) pipe. The 12-in. (30.5-cm.) pipe was placed directly over a tank connections from which lead to the injector.

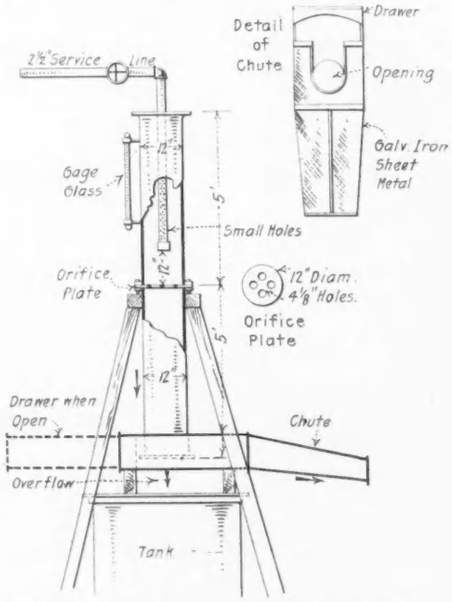


FIG. 2—CHUTE FOR REGULATING FLOW OF WATER

When calibration was undertaken it was found that some means of diverting the water in case the tank became too full should be provided. Consequently, a hollow chute was made of galvanized iron to fit snugly around the 12-in. (30.5-cm.) pipe. The upper end of the chute was left open and a sliding drawer having a

bottom, sides and back was made to fit snugly inside the chute. A hole, the diameter of the 12-in. (30.5-cm.) pipe, was cut out of the bottom of the chute, so that opening or pulling out the drawer allowed the water to flow directly into the tank and closing the drawer diverted the water. This arrangement permitted maintenance of a constant head upon the orifices and at the same time, if the tank became too full, permitted the water to be diverted for a short time.

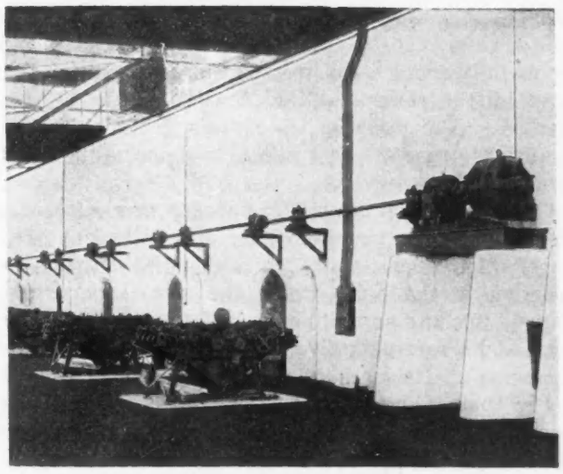
The accuracy of this method of measuring feed water is its chief feature. The data taken in the calibration tests were plotted, using a scale of sufficient size so that they could be read to 0.01 lb. (4.5 grams) per second and 0.02 ft. (6.09 mm.) of water column. In the tests the head on the water column was read every minute and the weight of water was taken from the calibration curve. The average percentage of difference between each two sets of reading was 0.246 per cent for one orifice and 0.040 per cent for two orifices.

SIMPLE MOTOR DRIVE PERMITTED BY TURBO-GEAR

Better Grouping Attained and Considerable Floor Space Saved by This Method of Driving Units in Steel Mill

In many mill installations, especially where line-shaft drives are employed, it is very desirable to have the driving and driven shafts in the same line. This arrangement results in a great saving in floor space and permits a more convenient and better grouping of the units. An interesting application of this character is shown in the accompanying illustration of a 100-hp. motor directly connected to a line shaft in the tin-plate mill of one of the largest steel companies through a turbo-gear. The speed reduction between the motor and line shaft is 730 to 122 r.p.m.

It may be observed that the gears and motors are mounted on base plates set upon concrete pillars in



APPLICATION OF GEARS IN TIN-PLATE MILLS

such a manner that the gear shaft and line shaft are directly in line. This arrangement is feasible as the turbo-gear requires no attention or adjustment after being properly installed. The turbo-gear is manufactured by the Poole Engineering & Machine Company, Baltimore, Md.

A SAFETY RESOLVE FOR THE COMING NEW YEAR

Illinois Company Makes Use of an Effective Poster at a Time When Workmen's Minds Are Particularly Receptive

When every one was thinking and talking about New Year's resolutions for 1917 the Bloomington & Normal Railway & Light Company took advantage of the receptive condition of its employees' minds to promote safety first. The idea was carried out by using posters worded as follows:

JANUARY 1, 1917

RESOLVED

that I will do everything in my power to further the

SAFETY FIRST MOVEMENT

in view of the fact that I am the chief beneficiary.

These printed posters, which measured about 24 in. by 30 in. (60.9 cm. by 76.1 cm.), were placed in conspicuous positions about the company's property. It is said that the effect was favorable.

OPERATING HINTS FOR OPERATORS OF STATIONS

Three Maxims: Cleanliness Must Always Be Observed; Keep Pets Out of the Station; Play Safe Always

In a recent issue of the *Au Sable News*, a publication of the Consumers' Power Company of Jackson, Mich., the following hints were given for the benefit of station operators:

Have a narrow brush with a wooden handle of suitable and safe length for cleaning off the tops of oil switches. (This does not refer to high-voltage switches, which must not be cleaned while energized.) If you cannot get the right sort of brush, make a swab of wiping rags. Be very careful in wiping around oil switches not to trip them. Sometimes a slight jar will trip an oil switch.

Examine all "dustless" dusters, brushes, etc., to make sure they are not constructed of wire.

Don't paint switch hooks, insulators or anything else that is to come into contact with the high-tension circuits. Paint may contain metals or minerals that are conductors of high-potential energy.

In cleaning or dusting the back of a switchboard, touch lightly and be careful not to short-circuit a relay or meter or trip a remote-control switch.

Keep pet animals out of stations as they are liable to ground switch tanks and short-circuit wires.

Treat all wires and apparatus, whether insulated or not, as alive and dangerous to touch or approach until they are known to be dead and safe to handle.

To avoid misunderstandings, telephone messages should always be repeated.

Cleanliness must always be practiced. Use your spare time in keeping all parts of your station clean, or see that this is done by some one else.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

THREE PER CENT OF RESIDENCE CUSTOMERS RANGE USERS

St. Louis County Puts 1415.1-Kw. Electric Cooking Load on Lines in Fifteen Months, or 15 per Cent of Connected Load

During the fifteen months period ended July 31 last the St. Louis (Mo.) County division of the Union Electric Light & Power Company placed in operation 238 electric ranges. These were all sold singly. The total connected load of these ranges is 1415.1 kw. (manufacturer's rating), an average of slightly better than 5.9 kw. per range. These figures do not include any increases over the installed ratings that have been made by customers.

In these fifteen months over 3 per cent of the company's residence customers became electric range users. Furthermore, approximately 15 per cent of the division's connected load as of July 31 was electric range load.

Later figures show that the company had on its lines on Sept. 1 last 260 electric ranges.

COMMITTEES IN CLEVELAND HELP INTERNAL MANAGEMENT

Four Committees in the Cleveland Electric Illuminating Company Assist in Co-ordinating Work of the Various Departments

A system of committees for handling internal affairs has been established by the Cleveland Electric Illuminating Company and is proving to be helpful in co-ordinating the work of the different departments. Four committees have been formed—efficiency, production, distribution and sales. The assistant general manager is chairman of each committee. The general purpose is to effect a closer degree of co-operation between the different departments and to settle many routine matters and details of co-ordination before questions are referred to executive officials for decision.

The various committees meet twice each week at stated periods. They pass on the advisability of recommending the authorization of all expenditures of any material size. It is understood that the member who is to present a subject must have his case fully prepared in advance so that no time shall be wasted by the committee. Estimates, arguments and other necessary data must be ready for the committee and be subjected to criticism and scrutiny.

The efficiency committee analyzes the expenses of all departments, recommends the introduction of economies and considers any methods of saving money that may be suggested. It passes upon all applications for additional men in any department; it makes recommendations affecting the combination of work, reduction of labor or elimination of work in any department which it deems not essential. These recommendations are submitted in writing to the management, and, if approved, are transmitted in an order to the department head affected. The committee is composed of the assistant general manager, ex officio, the auditor, the statistician and the head of the service department.

The production committee is composed of the assistant general manager, ex officio, the mechanical engineer and the heads of the electrical engineering, station operating and electric operating departments. This committee recommends to the management what action shall be taken in regard to contemplated work in connection with construction or extension of power houses or substations, the installation of steam or electrical machinery in power houses or substations, and, in general, the production of power. If the sales department should send a request for energy for some purpose, the matter would be referred in the preliminary stage to the production committee, which would decide whether the station or substation was in a position to carry the load at the time it was wanted. A definite recommendation as to whether or not the energy could be provided would be made by the committee. The committee is kept posted about possible large future contracts. Assuming that a new construction enterprise was approved, the head of the department concerned would get estimates or bids and submit them to the committee with his recommendation as to which offer should be accepted and a statement of the reasons for his position. If deliveries on apparatus should delay completion of construction, a member of the committee would get in touch with the manufacturer responsible and see what could be done to expedite his work. Until completion of the job the committee follows it closely. A statement of the main items on a construction job is put into written form by the committee and this is signed by every member. The jurisdiction of this committee covers operations from the coal pile to and including substations.

The distribution committee consists of the assistant general manager, ex officio; the superintendent of the construction department, which handles outside construction to the point where the service department takes it up; the superintendent of the service department, and a representative of the electrical engineering department. Its work is similar in distribution matters to that of the production committee in production questions. Each job is considered carefully and a preliminary estimate of cost is submitted to the committee before action is taken.

The sales committee considers matters affecting energy contracts, prospective loads, advertising and selling policies.

All decisions of the various committees are subject to the approval of the management. The plan is having the effect of making the different department officials more familiar with the work of other departments. It

is helping to keep the policies of the company uniform and to perpetuate practices of the past which have been found desirable. The committees find that the interchange of views brings out precedents in many cases which help to solve problems. Service can be checked with great care, and the conferences make it possible to keep every one advised promptly of affairs which affect his work.

Minutes of every meeting are recorded and filed in the general manager's office, together with copies of recommendations made and the resultant orders.

VALUE OF EMPLOYEE TO COMMERCIAL DEPARTMENT

Company Is Able to Increase Its Business Largely Because of the Leads Turned in by Men in All Departments

Labor is very scarce and is daily becoming scarcer. Evidences of this abound. In the commercial departments of central stations a definite dearth of salesmen, not an imaginary one, prevails.

A little more than a month ago the ELECTRICAL WORLD made an investigation, among other things, of this situation, and the results clearly indicated the shortage that exists. Department managers did not hesitate to say that they were short-handed.

It appears that men of higher caliber and greater integrity than the general run of salesmen are required. For that reason it is a doubly difficult problem to fill the gaps that have been made by the war or through the war. True, in some cases lighting companies have released their salesmen or part of them, but it will be found that in most cases this action was taken for certain local reasons. The fact is that for the most part the electric light and power utilities are eager and anxious to secure salesmen of high intelligence.

With this situation in mind, therefore, it has become evident to some and is becoming so to others that, in spite of the fact that the remaining men are accomplishing more work individually than they did when sales forces were complete, certain activities that the commercial department formerly pursued must be either curtailed or abandoned. This is true for two reasons —first, as indicated, the smaller force can do so much and no more; second, present conditions have developed a broadened and in many cases even more intense field for commercial activity.

It is thus plainly evident that the present force of salesmen must confine their efforts to obtaining the maximum business in the minimum time. To obtain the maximum result it is apparent that less time can be devoted to development work. Therefore some means must be devised to furnish the diminished sales force with leads of a particularly high character.

A good many plans have been tried in the past, many of which have been highly successful. One was tried out about three years ago in Minneapolis whereby customers furnishing leads that resulted in new business for the company received compensation in the form of energy-consuming devices according to a prearranged plan. The customer would arouse the desire to buy in her neighbor's mind and the company's salesmen clinched the sale. The results were considered at the time to be very satisfactory. Plans of a more or less similar nature have been worked out for house-wiring particularly, for this line of work could easily be widened to include appliances, for which there is now a growing demand occasioned again by labor scarcity.

Another plan which is not new but which perhaps offers more in this connection than any other is that of utilizing the after-hours services of employees. By offering to employees a satisfactory inducement in the form of a commission on every lead that results in a sale a very appreciable amount of new business may be secured at a small expense in time and money. Where the plan has been tried out the results have exceeded expectations. Employees from every department have responded with good leads, and, somewhat contrary to general belief, the essentially non-commercial departments—the operating and engineering departments—have been among the most profitable in this connection.

On the whole, the class of leads secured is good. A report from one company in the Middle West for one of the summer months showed that about 70 per cent of them were productive of business.

A report from the Public Service Company of New Jersey for the month of September last shows sales amounting to $5,320.41 resulting from leads by employees other than salesmen. It should be mentioned that gas as well as electric sales are here represented.

This business was done in twelve districts. One district did not report the amount. Following are the reports from the district managers, which show clearly two things—one, the large amount of business that resulted from a few leads; the other, the much greater amount of business that would have resulted had more strenuous efforts been made to interest more employees in this work:

The Hudson division reports sales made during September from prospects turned in by employees not regular salesmen as follows: Jersey City, $589.86; Bayonne, $241.18; Hoboken, $73.15; North Hudson, $346.05; total, $1,250.24.

The Orange district reports sales for September resulting from leads furnished by employees other than salesmen to the amount of $457.55. Messrs. Davis, McCormick, R. Wilson, Schoen, Masterson, Murphy, La Salle, O'Neill, Schmick, Rice, Thierbach, Beames, Ferguson, Curtis and Hostetter turned in the leads.

Fourteen prospects turned in at the Somerville office resulted in sales amounting to $335.25. P. C. Carolan, F. A. Bourke, E. J. McWilliams, S. W. McCrea and F. W. Pierce participated in the order named.

Rutherford reports sales from leads during September by employees not salesmen to the amount of $238.25. R. Fletcher, F. Gunther, E. Schaeffer, J. B. White and J. Kane turned in the leads.

The Montclair district reports sales made during September from prospects turned in by employees not salesmen amounting to $482.20. Mrs. E. Hampton, E. DeNourie, E. Sinsheimer, C. Russell, C. Benz, P. Warfield, A. M Stewart and R. Atwell contributed in the order named.

The Morristown district reports September sales resulting from leads furnished by employees not salesmen amounting to $272.43. Harry Huyler, F. C. Michelfelder, James Cooney and F. C. Burnham turned in the leads.

The employees of the Summit district other than those connected with the sales department deserve a word of thanks and appreciation for the number of appliance prospects which have been closed through their efforts. This is a very good showing, and we are glad to see that all the employees in this district are extending all the help possible to reach our bogie on sales for 1917.

Hackensack office men not in the new-business department turned in prospects that netted sales amounting to $119.60 in gas appliances. J. Spiers, T. Owen, D. Brown, G. Henkel, C. Broskie, W. Longstreet, G. Vetter, H. Eisen-

hauer and F. Broskie participated in the order indicated.

Ridgewood reports September sales resulting from leads by employees not salesmen amounting to $391.25. W. Smith, M. G. Schreck, W. E. Pohlig and A. E. Seibel participated.

During the past month gas appliances to the amount of $701.53 were sold in the Trenton district through leads turned in by employees other than those connected with the sales department. This is a very creditable showing and is certainly deserving of mention. In the same office electric sales amounting to $185 were made from prospects.

The Burlington district reports sales resulting from prospects turned in during September by employees not salesmen amounting to $507.51. T. P. Morris, W. C. Dannehower, Harry Kemmerle, F. J. King, F. B. Cook, W J. Stradling and W. S. Gusrang, all collectors, participated in the order named.

The Camden district reports sales resulting from prospects turned in during September by employees not salesmen amounting to $379.60. A. Applegate, A. Summers, H. Delacroix, S. O. Kelly, A. Stones, F. A. Lynch, R. Parker and J. Inman participated in the order named.

COMPLAINERS VIEWED IN THE LIGHT OF ASSETS

Large Southern Property Tells Employees to Ask Dissatisfied Friends to Send in Their Complaints to the Company

Electric service has developed to such an extent and utilities take an attitude toward the public so different from that assumed a decade or more ago that complaints are no longer numerous in well-regulated properties nor are they considered as nuisances. In fact, some properties welcome complaints because they offer an opportunity to show the service of the company and thereby to make friends. One of the properties that believe complaints to be real assets is the Birmingham (Ala.) Railway, Light & Power Company, and with this thought in mind it is counseling its employees to ask their dissatisfied friends, if they have any, to send in their complaints. Following is the company's opinion as contained in the employees' weekly paper, *The Buzzer:*

One of the greatest difficulties the company has to deal with is the lack of general understanding of its system and organization. Misunderstanding arises because the consumer does not know what lies back of his electric or gas meter; least of all does he know that ingenious safeguards have been devised to protect him against errors or injustice.

The company operates on such a small margin that even the saving of a 2-cent stamp in sending a receipt each month is an item, so it has been compelled to build service on a basis of good average performance. The average is maintained so well that probably but two or three consumers out of a thousand will have reason to complain each month. When these consumers do complain, however, the company can afford to go considerable length in investigating, because the service is likely at fault or the consumer has run into something he does not understand and it is worth while to enlighten him.

The consumer thinks his electric light or gas bill is too high this month. He says it does not seem possible that he used that much. The company does not maintain he used so much electricity or gas; it takes the stand that he appears to have done so, according to its best devices for measuring, but it will investigate. Then the machinery it brings to bear gives the consumer a liberal education in the art of keeping track of trifles.

First, there will be an investigation, and only one meter out of twelve about which consumers complain is found to be wrong, and only one out of thirty investigated is running fast, against the consumer; the others are correct or slow, against the company. If the meter is correct, then the difficulty will be to trace further. This will often furnish a clew to the waste in electricity. Servants have been careless in leaving the lights on or the scrubwoman in the office will light a whole floor while she empties the waste baskets.

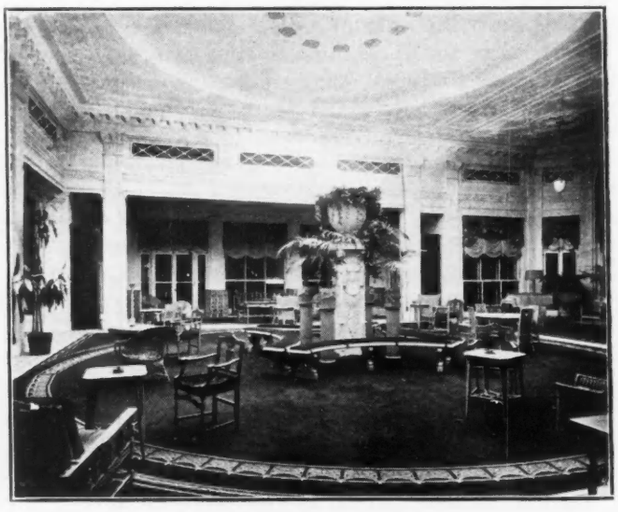
The dissatisfied consumer who fifteen years ago was considered a nuisance has been turned into an asset when the consumer learns how fair the company can be. He tells others. The company is not only working hard to create good will and courtesy through courteous handling of complaints and correction of misunderstanding, but is taking steps to inform the whole public about its method to forestall unfounded complaints.

LIGHTING LARGE ROOMS FROM PEDESTAL FIXTURES

Indirect System Used with Excellent Effect to Accentuate the Architectural Beauty of Portion of a Club House

In designing the interior of the South Shore Country Club at Chicago it was thought desirable that the rooms should be made more pleasant in the evening hours than in daylight if possible. For this reason especial attention was given to the artificial lighting, with the result shown.

There are two garden foyers which form the terminus of the promenade, each of which measures 36 ft.



INTERIOR LIGHTING WITH PEDESTAL FIXTURES

by 72 ft. (10.97 m. by 21.94 m.). The high arched ceilings are tinted a faint sky blue. The light is all supplied from a 7-ft. (2.13-m.) pedestal which contains two 500-watt gas-filled tungsten lamps in silvered mirror reflectors. The absence of harsh shadows and glare in the room are noticeable and every detail of the decorations has been clearly brought out. The accompanying illustration is a view in the solarium, which overlooks Lake Michigan. This room is 43.5 ft. (13.25 m.) square and has a 21-ft. (6.4-m.) ceiling. The lighting is from five 500-watt gas-filled tungsten lamps in silvered mirror reflectors concealed in the 10-ft. (3-m.) pedestal in the center of the room. An intensity of illumination is secured which gives this exquisitely furnished interior an atmosphere of restfulness and refinement. The lighting of these rooms was worked out by the engineering department of the National X-Ray Reflector Company of Chicago.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

THE PROPERTIES AND USE OF FURNACE ELECTRODES

Rate of Consumption, Methods of Protecting and Cooling, Arrangements for Attaching Conductors, and Other Considerations

IN THE Sept. 21 issue of the London *Electrical Review* appeared an interesting article on the properties and utilization of electric furnace electrodes. The article, which is a continuation of a previous one, dwells on the rate of consumption of electrodes, methods of protecting and cooling, means of attaching conductors, and

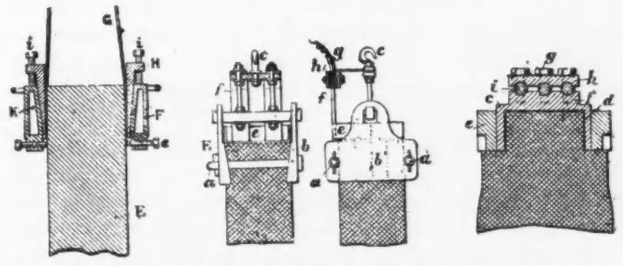


FIG. 1—SEVERAL METHODS OF CLAMPING CONDUCTORS TO FURNACE ELECTRODES

arrangements for controlling the electrodes. Extracts therefrom are given in the following paragraphs:

Consumption of electrodes is due primarily to the following causes: Dissociation by current; the working voltage may be either too high or too low; chemical combination of the electrodes with oxygen; solution of the carbon in the metal, and direct oxidation by atmospheric oxygen. The electrodes should not be burned too close to the terminal clamp nor should they be rejected as new electrodes may cost £17 ($82.50) per ton and stumps may be worth only 32s. ($7.35) per ton as raw material for fresh electrodes. The scrap value is thus only 10 per cent of the value new. To utilize the stumps arrangements can be made for fastening them to the new electrodes, using screw connections or lap-joined construction.

The most effective protection for electrodes consists of a sheath of incombustible material. Mixtures which have been proposed for this purpose are retort coke and sodium silicate; lime and limestone with carbon, and potassium or sodium silicate with chalk. These mixtures applied cold form a covering which is a good resistant to heat. Other protective coatings used are asbestos wool with silicates, milk of white clay, and silundum. The last is an amorphous compound resembling carborundum. It is refractory, incombustible, and, being a compound of carbon and silicon, it is useful for protecting electrodes in ferro-silicon furnaces. An iron netting may be used to support a paste of sodium silicate and clay or of kaolin and asbestos. Sometimes granular material unaffected by oxidizing gases is embedded in the surface of the electrode. Quartz, alumina or carborundum may be used, according to the nature of the products made in the furnace. Rigid envelopes of asbestos board or sheet iron have also their uses, though care is required to prevent air circulating between electrode and sheath, which then forms a draft chimney and intensifies the damage.

In this connection Ch. Louis recommends that the electrode be protected by an agglomerate of magnesia or dolomite, 3 cm. to 5 cm. in thickness, inside a jacket of 1-mm. sheet iron. The agglomerate is heated for mixing and contains 6 to 7 per cent of pitch and 5 to 8 per cent of tar. Adherence on the electrode is increased by chipping its surface and painting it with tar. The sheath being held in place by an external mold, the agglomerate is packed tightly between it and the electrode. The mold is then withdrawn, and a joint is made at the top between sheath and electrode by a paste of silicate or refractory earth. It is not essential to rebake an electrode thus protected.

The Gin process is to embed the electrodes in a carbon agglomerate. With this end in view the electrodes are formed of several cores (say, eight or ten), and the agglomerate is a mixture of coke or ground electrode stumps with pitch or tar. The agglomerate forms simply a mechanical bond between the electrodes. It is not traversed by any considerable fraction of the current and is, therefore, at a much lower temperature than the cores and is less exposed to oxidation. Its protective action endures beyond the point in the furnace at which iron sheathing would be melted away.

It is evident that a protective coating of any sort carries its impurities into the manufactured product. and for this reason it is sometimes better to do without

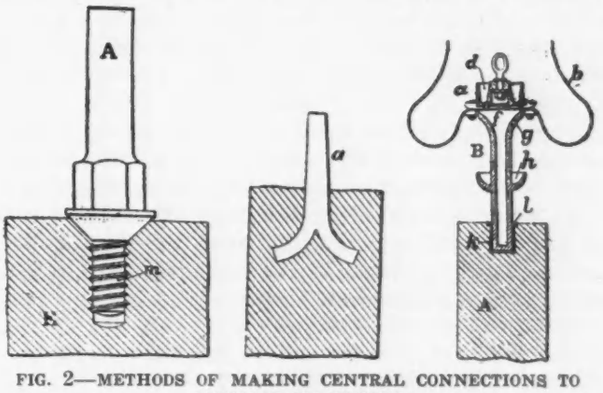


FIG. 2—METHODS OF MAKING CENTRAL CONNECTIONS TO FURNACE ELECTRODES

the coating and simply modify the shape of the electrodes.

The rate of electrode consumption referred to unit weight of product manufactured varies widely with the product concerned and with the type of furnace employed. For instance, in the manufacture of 25 per cent ferro-silicon the electrode consumption is about 3 mm. per hour, increasing to 4 mm. when a 58 per cent silicon

alloy is made. Manganese-silicon alloys involve a mean consumption of 3 mm. and calcium carbide of 2 mm. per hour. All these figures refer to covered furnaces charged continuously in which consumption is always a minimum.

In aluminum manufacture the electrode acts not only as a current conductor but also as a comburent, and its consumption is generally proportional to the quantity of metal produced—say, 700 gm. per kg. (1500 lb. per ton) of metal produced.

In steel furnaces of direct-production type, with electrodes about 2 m. long, the consumption varies with the process. The following table shows the net weight of electrodes burned effectively in various works:

Furnace	Electrode Consumption per Ton of Steel Kg.	Lb.	Remarks
Stassano, Turin	7 to 10	15½ to 22	Charged cold
Girod, Urgine	11.4	25	....
Chapelet, Allevard ...	11.3	24.8	....
Heroult, LePraz.....	17.5	38.5	....
Lindenburg, Remscheid.	2.68	5.9	Fluid charge

Allowing for stumps of utilization and starting directly from ore, the average net consumption of electrodes is now 4 kg. to 5 kg. (8¾ lb. to 11 lb.) per ton of steel. In some cases electrodes have lasted for 1200 working hours, corresponding to more than six weeks of continuous operation.

Electrode Terminals and Cooling Arrangements

The manner in which electrodes are supported while being left free for up and down adjustment at will and the manner in which connection is made to the electric supply mains play an important part in the maintenance and durability of electrodes. Bad fitting may cause the electrode to become red hot at places, and this in turn leads to breakage or excessive combustion. The damage is cumulative because the resistance of carbon decreases with increasing temperature; hence current passes by preference through the overheated parts, aggravating their state and exposing them to yet more rapid depreciation.

There are several methods available for the attachment of carriers to electrodes, but the two types at present in use are clamp connections and central connections. Cooling may be secured in all cases by a water basin near the connection or by a trough of water surrounding the electrode and provided, if necessary, with radiating ribs or wings.

Several means for effecting central connections to the ends of electrodes are illustrated in Fig. 2. The bronze connector at the right is made hollow for water cooling. Fresh water is supplied at *d* in the basin *a*, and runs into the hollow stem *f*. Overflow runs into the annular reservoir *h*, whence it evaporates; no water reaches the joint between connector and electrode.

Generation, Transmission and Distribution

Electricity Supply at Redditch.—Descriptions of the alterations which were necessary in the electric service system at Redditch to permit developing the power load under proper conditions. Methods were described for overcoming difficulties imposed by the interconnection of two systems which did not employ the same form of energy or same frequency and in which the distribution systems were of different types. The extent to which the old generating stations and substations were utilized or remodeled was also outlined. To permit paralleling a 70-cycle single-phase and a 50-cycle three-phase system a motor transformer was used, the stator of one machine being arranged so that it could be rotated relative to the other, thus permitting paralleling on either the single-phase or three-phase side. As all of the auxiliary motors of the new plant are driven by means of three-phase motors and need to be running before the turbo-generators can be put under load, arrangements were made so that the motor-transformer could be started single-phase from a small reciprocating single-phase alternator to enable starting the circulating and ventilating motors of the large three-phase turbo-generator. Owing to the large number of single-phase motors and transformers on the old single-phase system, the power factor is low, but the two synchronous motor-transformers are of considerable assistance, since by overexciting their fields it is possible to reduce considerably the idle current in the turbo-alternators. Such of the original single-phase low-tension system as was in good condition has been connected to new four-conductor cables between phase wires and neutrals, the load being balanced as evenly as possible between the phases. Similar arrangements have been made for connecting the single-phase high-tension mains.—London *Electrician*, Sept. 14, 1917.

Wires, Wiring and Conduits

Protection of Cables Against Electrolysis.—After pointing out that preventive measures are preferable to steps taken after the defect has become apparent, the author outlined methods of making regular and periodic inspections, described the apparatus to use, and suggested protective measures which can be taken. The usual procedure is to provide a conductor to carry out the current which would otherwise leak to earth. Sometimes, however, cables situated in the vicinity of conduits, metal bridges or earth saturated with sea water are positive with regard to earth, the adjacent good conductors deriving from outside the cable the large portion of the current carried to the spot with the cable in question and then by returning it again re-establishing a negative potential. In such a case the expense of installing a leakage conductor can be avoided by isolating the negative portion of the cable from the rest of the network, the continuity of the armor covering being preserved by running an isolated conductor parallel to the disconnected circuit. In some cases a leakage conductor can be replaced by guard plates which serve to drain away outside the cable the currents which would otherwise pass into the earth from its surface. This arrangement, which can be employed when a leakage conductor would prove unduly expensive and the leakage currents are not very strong, causes the decomposition to take place in the plate where it enters the soil instead of on the surface of the cable.—London *Electrician*, Sept. 14, 1917 (abstracted from Annales des Postes, Télégraphs ét Téléphones).

Electrophysics and Magnetism

Resistance and Magnetization.—C. W. Heaps.—This paper describes experiments made to bring out the relationship between structural changes producing magneto striction and resistance change induced in iron and nickel by magnetization. The theory of the effect of magnetic field on resistance has been developed to cover

the cases of longitudinal and transverse magnetic fields. The theory indicates that there is a greater transverse than longitudinal effect. Experiments have been made with crystalline graphite in different forms. In compressing graphite powder the effect of a magnetic field on the resistance is greater with coarse powder than with fine. This implies that in a substance composed of large crystals the effect is greater than in one composed of small crystals. From the study of graphite it is concluded that crystal structure is an important factor to consider when experimenting on the conductivity of any substance in a magnetic field. From experiments on a specially prepared sample of cadmium it was concluded that comparisons of the longitudinal and transverse effects may be made legitimately by using an ordinary wire as a specimen. Assuming that wires of other metals are like cadmium in this respect, calculations of the number of electrons per unit volume and of the free period of the electrons have been made for several metals. This theory affords a satisfactory explanation of the behavior of all paramagnetic and diamagnetic substances which have so far been examined.—*Physical Review*, October, 1917.

Reversal of the Hall Effect in Alloys.—ALPHEUS W. SMITH.—From the results of his experiment the author concludes that there has yet been no satisfactory suggestion advanced to account for the reversal of the Hall effect under the conditions considered in his paper. The explanation of this interesting fact is probably to be looked for in the structure of the alloy, particularly in the interstices between the vibrating atoms.—*Physical Review*, October, 1917.

Color Temperature Scales for Tungsten and Carbon.—E. P. HYDE, F. E. CADY and W. E. FORSYTHE.—Working on the basis that the color temperature is greater than the true temperature of a metal and that the brightness temperature (ordinarily called black-body temperature)

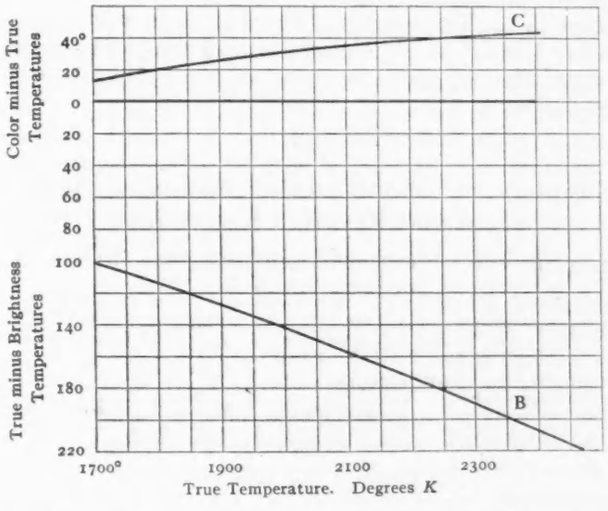


FIG. 3—RELATION * BETWEEN COLOR, TRUE AND BRIGHTNESS TEMPERATURES OF TUNGSTEN

is less than the true temperature, the latter was found for tungsten and carbon using Worthing's data. The color temperature is much nearer the true temperature than the brightness temperature. For carbon the difference between the color temperature and the brightness temperature is given, the true temperature being unknown. The relation is also determined between color temperature and lamp efficiency in lumens per watt so that it may be possible to calculate the color temperature and also the true temperature by measurement of lamp efficiency. The relation between color temperature and watts was found within observational errors to obey

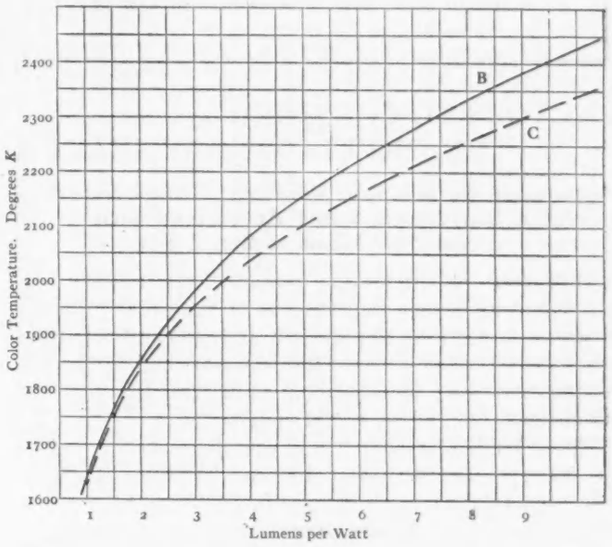


FIG. 4—RELATION * BETWEEN COLOR TEMPERATURE AND LAMP EFFICIENCY OF TUNGSTEN

approximately an exponential function. It is shown that for tungsten the exponent cannot be a constant but must decrease slightly with a change from a low to a high temperature. The apparatus and methods of conducting the tests were described, the correction determinations outlined and the experimental results discussed. The black-body color temperatures, or simply the color temperatures for tungsten and untreated carbon, are given from direct observations against the carbon-tube black-body furnace plotted against lumens per watt of the lamp.—*Phys. Review*, 1917.

Astronomical Consequences of the Electrical Theory of Matter.—A. S. EDDINGTON.—Gives present discordances between gravitational theory and observations for the four inner planets.—London *Philos. Mag. and Journal of Science*, September, 1917.

Deterioration of Muntz Metal.—Brass consisting of sixty parts copper and forty parts zinc, such as is used in condenser tubes, etc., sometimes deteriorates in such a manner that the metal changes its color to copper red and becomes very weak and brittle. This change of properties is due to selective corrosion of the alloy when exposed to the action of some electrolytes, particularly sea water. In examination of the microstructure of some samples of this metal it has been found that the zinc-rich constituent is leached out, leaving a skeleton of weak pulverulent copper in its place. Conditions which appear, from an examination of corroded samples, to accelerate corrosion are the microstructural composition of the alloy, contact with electronegative metals, adhering deposits of zinc chloride, the thoroughness of the annealing, the temperature of the electrolyte, and the stresses to which the metal was subjected.—*Technologic Paper No.* 103, Bureau of Standards.

*B, author's data; C, Paterson and Dudding's data.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

FACTORS TO CONSIDER IN DEVELOPING RESEARCH

Preparation of Men for Research Work—Necessity of Universities Being Acquainted with Problems—Ideals to Strive For

Industrial and scientific research has recently received a tremendous impetus due to the great war, but research is destined to play just as important a part in the reconstruction period after the war, and in the following period of international industrial life, in both its competitive and co-operative aspects.

Three kinds of research that are of use in the electrical industry are embraced by the following subjects: (1) Industrial research on specific problems mostly carried on by manufacturers, operating companies and commercial laboratories; (2) scientific research, which is the proper province of teachers and investigators in physics, mathematics, chemistry, etc.; (3) semi-industrial research, in which teachers and advanced students in electrical engineering are engaged. In order to obtain the best results there must be closer co-operation between these branches of research. A special research committee, such as was recommended at the recent Philadelphia meeting of the American Institute of Electrical Engineers, would be highly beneficial along this line, and the National Research Council can accomplish good results on a larger scale. The membership in special research committees should, as much as possible, include representatives of manufacturers, operating concerns, construction companies and men in applied and pure sciences.

Research and advance study should be considered by university managements as the duty and privilege of college teachers who are capable of productive scholarship. Such men should be afforded sufficient time and facilities to pursue research for the benefit of their students, of the industry and of the whole world. While the primary function of the university is to train men, and research results are only secondary, some professors should be skilled and devoted original investigators and scholars in order to train and inspire students in research. Broad fundamental training of undergraduate students is preferable to an early specialization. However, it is highly advisable for gifted students to spend a year or two after graduation in scientific study and research in some university.

In planning research work or courses of instruction in college the ideal to strive for is that a college should be life itself and not merely a preparation for life. The student should exercise his mental faculties and develop his character on actual life problems (Montessori system) and not merely learn abstract things for possible future use. Colleges of pure and applied science should strive to create a background of research in their institutions by carrying on investigations and by impressing upon the students the importance of a searching, analytical attitude of mind toward things that surround them. Mathematical and general theoretical research ought to receive more attention, otherwise crude empiricism with its wasteful experiments and rule-of-thumb formulas will continue to prevail. A rational theory summarizes many experiments, makes them unnecessary, and permits the prediction of the performance of new and different kinds of apparatus.

It seems most desirable that the technical colleges should pre-eminently carry on general and not narrow industrial researches in their laboratories, researches of such a nature as may advance applied science, stimulate careful observation on the part of students, contribute to the published fund of available technical information, supply new knowledge to the teaching staffs, and train students for entering industrial research.

General problems with which the industry is confronted for the first time should be turned over to the universities as early as possible because these problems are particularly valuable in the training of future engineers for the industry. Moreover, knowing what the new problems are, the teachers are inspired for research along important lines and thus early develop important relations and data. While specific industrial research problems of manufacturing companies as a rule cannot be given over to colleges for solution, owing to the patent situation, necessary equipment, required secrecy, close connection with routine manufacturing work, etc., these limitations do not hold to the same degree with operating companies.

An ideal international system of research would be one in which the pure science colleges should lay the foundations of future industries by enlarging and disseminating the world's knowledge of the basic scientific principles. The technical colleges should do the same for applied science, while at the same time taking a share in the economic applications of science to industries. The industries themselves should undertake their own researches, under the guidance of qualified research specialists.

Summary of Investigations, Available Apparatus and Research Suggestions

INVESTIGATIONS UNDER WAY OR COMPLETED (RESEARCH WORK REPORTED SINCE OCT. 20)*

CARBON, RESISTIVITY OF.

Resistivity of carbon filaments as a function of temperature.—*H. Le Chatelier, Paris, France.*

CURRENT TRANSFORMERS.

A new method of comparing ratio and phase angle of current transformers.—*F. B. Silsbee, Bureau of Standards, Washington.*

Investigation of cathodic corrosion of lead cable sheaths.—*Burton McCollum, Bureau of Standards, Washington.*

SUGGESTIONS FOR RESEARCH

INSULATORS.

Practicability of fused quartz insulators.—*A. I. E. E. Committee on Transmission and Distribution.*

RELAYS.

A system of protection which will take care of all possible troubles in a power transmission or distributing system which is fed from several power houses, each of which may feed from either one or two transmission lines to the load center. Proper relay protection should clear any line or section in trouble and not interrupt service on any other section.—*E. P. Peck, Georgia Railway & Power Company, Atlanta, Ga.*

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRICAL MANUFACTURERS DISCUSS LABOR CONDITIONS

Chief Topic Before the Electrical Manufacturers' Club at Hot Springs Meeting—L. A. Osborne the New President

The Electrical Manufacturers' Club met in semi-annual session at Hot Springs, Va., last week. The chief topic of discussion was the national labor situation. L. A. Osborne, vice-president of the Westinghouse Electric & Manufacturing Company, who is chairman of the advisory committee to the National Industrial Conference Board, which committee made a recommendation on Sept. 6 to the Council of National Defense and also a few weeks ago to the United States Chamber of Commerce at its Atlantic City convention, reviewed the present situation. Mr. Osborne drew attention to the fact that so far the recommendations of the committee had not been acted upon by the Council of National Defense. He said that these recommendations, having for their object the securing of industrial peace during the period of the war, were reasonable and had been indorsed by over 60,000 manufacturers, and it is a well-considered opinion of industry that they are the best means of insuring the continuance of essential war production.

W. L. Merritt of the Anti-Boycott Association was also a speaker. He told at some length of his work in connection with that association, with especial reference to the attempt which had been made to shut out electrical apparatus and wiring supplies in certain districts, a subject of great interest to the assembled manufacturers. He made a plea for the socialization of labor and for a general movement on the part of all elements which would have for its object the fulfillment by labor of its obligation to the nation in the present emergency. The aid and co-operation of the Electrical Manufacturers' Club were solicited to further this movement.

PROSECUTION OF THE WAR

With relation to the activities of the manufacturers of electrical apparatus and supplies in regard to the successful prosecution of the war, the Electrical Manufacturers' Council, which is composed of four members each from the Electrical Manufacturers' Club, the Electric Power Club and the Associated Manufacturers of Electrical Supplies, proposed the formation of a general war service committee of the industry. This will be made up of two members of each of the organizations named, and it will act as representative of the manufacturers of electrical apparatus and supplies before the finished products section of the War Industries Board. This proposal of the Manufacturers' Council is indorsed by the Electrical Manufacturers' Club and by the Electric Power Club. It will be brought to the attention of the Associated Manufacturers of Electrical Supplies at an early meeting, and this organization will also indorse and act on the proposition. Through the proposed war service committee the electrical manufacturing industry will be guided.

The following officers of the Electrical Manufacturers' Club were elected for 1918: President, L. A. Osborne, vice-president Westinghouse Electric & Manufacturing Company, New York; vice-president, H. B. Crouse, president Crouse-Hinds Company, Syracuse, N. Y.; secretary, Shiras Morris, president and treasurer Hart & Hegeman Manufacturing Company, Hartford, Conn.

One of the essential objects of the Electrical Manufacturers' Club being that of the establishment of good social relations between the manufacturers, much of the time was spent in interchanging experiences and in out-of-door amusements.

ACTIVE WORK OF MR. OSBORNE

Loyall Allen Osborne, the newly elected president of the Electrical Manufacturers' Club, is an active official in various Westinghouse properties. In addition to his office as vice-president of the Westinghouse Electric & Manufacturing Company he is vice-president of the New England Westinghouse Company, president of the J. Stevens Arms Company, vice-president of the Westinghouse Lamp Company and vice-president of the Canadian Westinghouse Company.

L. A. OSBORNE

Born in Newark, N. J., on June 22, 1870, Mr. Osborne was graduated from Cornell University with the degree of mechanical engineer. Directly after graduation he became identified with the Westinghouse Electric & Manufacturing Company, and in his subsequent continuous connection with that organization he has advanced rapidly. In 1895 he became assistant superintendent and two years later was made assistant to the vice-president. Becoming manager of works in 1899, he was made a vice-president in 1902.

DAYLIGHT SAVING AND CONSERVATION OF FUEL

Dr. Garfield Indicates that the Subject Is Receiving Earnest Attention with a View to Urging Congressional Legislation

The New York Daylight Saving Committee has decided to renew its activities and met on Nov. 13 in the office of Marcus M. Marks, president of the borough of Manhattan. It concluded to begin a campaign to secure the passage of the daylight-saving bill at the next session of Congress. This bill was passed by the Senate but not by the House of Representatives at the last session.

To a letter to Dr. Garfield, the Fuel Administrator, Mr. Marks received a reply saying:

"The subject of daylight saving is receiving very earnest attention at the present time with a view to urging upon Congress such legislation as seems to be in the interest of fuel conservation."

WASHINGTON AUTHORITIES RESTRICT SIGN LIGHTING

Order Not General and Complete Because It Is Desired to Give Opportunity to Readjust Business to New Conditions

The use of coal in the production of electricity for non-essential purposes is curtailed throughout the United States in an order issued this week by Fuel Administrator Garfield and published in full in this issue of the ELECTRICAL WORLD. The order will prevent the lighting of advertising signs and other outdoor electrical display until 7.45 at night. Such signs will be forced to darken at 11 o'clock at night. It is estimated by the Fuel Administration that this order will save 50 per cent of the fuel now used in maintaining this class of electrical display.

According to an announcement of the public information division of the Fuel Administration, Dr. Garfield is anxious to avoid interference with legitimate business just as far as possible, but he is determined to see that the industries essential to the conduct of the war and the domestic consumers of the country have coal.

The order makes an exception of signs maintained by small merchants for the purpose of directing customers to their places of business. These, if not of an unreasonable size, will be permitted to continue while the establishment is open for business.

Experts of the Fuel Administration have determined that at least 250,000 tons of coal per year are used for this display electric lighting. This amount, it is estimated by the Washington authorities, would keep 100,000 people warm throughout the winter. The public notice issued on behalf of the Fuel Administration says that a committee of the gas and electric service companies of the country co-operated with the Fuel Administration in determining the need for a limitation on coal consumed in supplying energy for the outdoor display lighting and that the restrictive order has the approval of this committee.

It is expected by the Fuel Administration that the restrictive order will result in an incidental reduction in addition to the 50 per cent curtailment directly ordered. With the effectiveness of the display signs cut in two, it is regarded by the Washington authorities as probable that advertisers will reduce their use of outdoor displays.

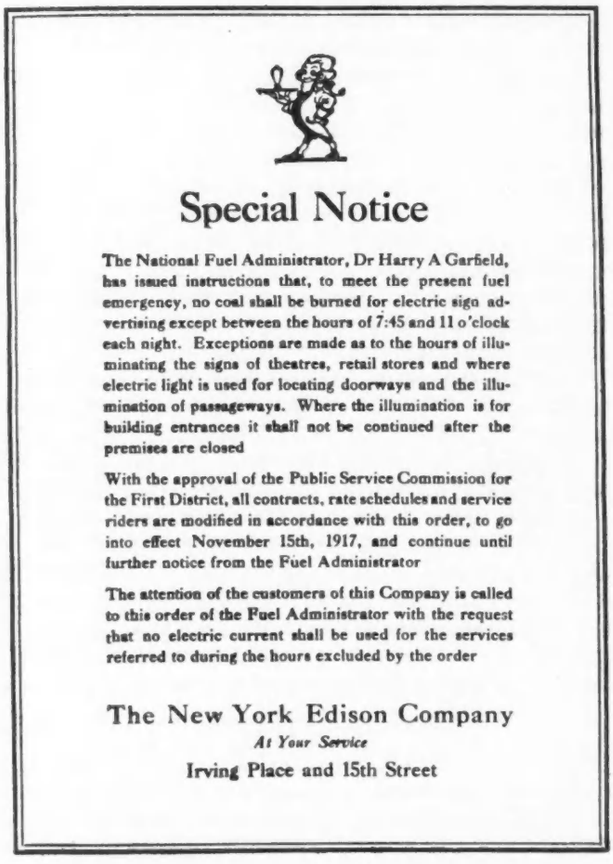
It is announced furthermore that the restrictive order was not made general and complete because the Fuel Administration desired to give the interests involved an opportunity to readjust their business.

It is evident that the order does not apply to plants operated solely by water power.

MAKING THE SIGN ORDER EFFECTIVE IN NEW YORK

Rider to Rate Schedules Approved by Public Service Commission and Notice to Consumers Put in Daily Papers

Rapid steps were taken in New York City to make the sign regulative order of the federal Fuel Administration effective on Nov. 15. The accompanying illustration shows the advertisement published in the morning news-


Special Notice
The National Fuel Administrator, Dr Harry A Garfield, has issued instructions that, to meet the present fuel emergency, no coal shall be burned for electric sign advertising except between the hours of 7:45 and 11 o'clock each night. Exceptions are made as to the hours of illuminating the signs of theatres, retail stores and where electric light is used for locating doorways and the illumination of passageways. Where the illumination is for building entrances it shall not be continued after the premises are closed
With the approval of the Public Service Commission for the First District, all contracts, rate schedules and service riders are modified in accordance with this order, to go into effect November 15th, 1917, and continue until further notice from the Fuel Administrator
The attention of the customers of this Company is called to this order of the Fuel Administrator with the request that no electric current shall be used for the services referred to during the hours excluded by the order
The New York Edison Company
At Your Service
Irving Place and 15th Street

papers on that date by the New York Edison Company.

A rider to the rate schedules of the company was filed promptly with the New York Public Service Commission, First District, and has the approval of that body. It reads:

"Any and all rate schedules, contracts, service riders and regulations of this company that may be affected by order No. 137 of the United States Fuel Administrator, Washington, D. C., issued under date of Nov. 13, 1917, to take effect Nov. 15, 1917, are hereby modified and amended so as to comply in all respects with said order and as modified shall remain in effect until further notice."

Order of the United States Fuel Administrator Regulating the Use of Coal for the Purposes of Generating Electricity for Use in Operating Illuminated Advertisements, Notices, Signs, Etc.

IT APPEARING to the United States Fuel Administrator that it is essential to the national security and defense, the successful prosecution of the war and the support and maintenance of the army and navy, and to lessen or prevent the waste of coal which at the present time is and during the continuation of the war will be, in the judgment of the United States Fuel Administrator, needed for the purposes aforesaid, and to secure an adequate supply and equitable distribution, and to prevent, locally and generally, scarcity of coal, and to facilitate the movement of coal for the purposes aforesaid, that the use of coal in the manner and for the purposes hereinafter set forth, and that the employment for such use of the present facilities, already inadequate for the prompt and sufficient shipment, transportation and delivery of coal needed for the purposes aforesaid, should be limited and restricted, in order that the essential purposes first hereinbefore referred to may be carried out, and that so far as possible the production, sale, shipment, distribution and apportionment of coal among dealers and consumers, domestic and foreign, may be maintained to the extent sufficient to meet the governmental, commercial and domestic requirements for coal,

THE UNITED STATES FUEL ADMINISTRATOR, acting under authority of an executive order of the President of the United States, dated Aug. 23, 1917, appointing said Administrator, and in furtherance of the purpose of said order and of the act of Congress therein referred to and approved Aug. 10, 1917,

HEREBY ADJUDGES that in his opinion the use of coal for any of the purposes hereinafter described except to the extent hereinafter indicated is wasteful, and that any person using any coal for such purposes except as aforesaid is engaging in a wasteful practice or device in handling or dealing with coal, and that the use of coal for such purposes except as aforesaid is prejudicial and injurious to the national security and defense and a cause of scarcity, locally and generally; and

HEREBY ORDERS AND DIRECTS that until further or other order of the United States Fuel Administrator and subject to modification hereafter from time to time and at any time:

1. Upon and after the fifteenth day of November, 1917, no corporation, association, partnership or person engaged in whole or in part in the business of furnishing electricity for illuminating or power purposes, and no corporation, association, partnership or person maintaining a plant for the purpose of supplying for their own use electricity for illuminating or power purposes, shall use any coal for the purpose of generating, producing or supplying electricity, or supply or use electricity generated or produced, in whole or in part, by the consumption of coal, for the purpose of providing, maintaining, lighting or operating **before the hour of 7.45 p. m. or after the hour of 11 p. m.,** electrically illuminated or display advertisements, notices, announcements, signs, designation of the location of an office or place of business or of the nature of any business, electric searchlights or (external) illumination or ornamentation of any building, except in the interior of buildings, and except as in special cases hereinafter further or otherwise provided or limited, namely:

(a) This order shall not apply to the United States government, the government of any commonwealth or state of the United States, or to any city, county, town or other governmental subdivision in any such commonwealth or state;

(b) This order shall not apply to the maintenance of street lights by any city or town or within any city or town under a contract with the officials thereof for such maintenance, or to the maintenance of any lights for any purpose by, or in compliance with orders of, any public authorities;

(c) **Electric signs affixed to the street fronts of buildings over the street entrances thereof or over the street entrances to stores, shops or other places of business therein, or extending therefrom over the sidewalks, for the purpose of announcing the name or business of a retail shop or store, or the name and location of a theater or other place of amusement or of a hall or other place of public assembly,** together with the name of the play or other entertainment given therein, or of the purpose of any public assembly to be held therein, as the case may be, **may be lighted or illuminated or operated by electricity generated or produced by the use of coal, during the period from one-half hour after sunset until such time, not later than 11 o'clock in the evening,** at which time in the case of a place of business the same is closed for the conduct of business therein in the same manner and to the extent that such business is conducted therein during the daytime business hours, and in the case of places of amusement and public assembly hereinbefore referred to until one-half hour after the time fixed for the beginning of an entertainment or of the meeting or other public assembly, as the case may be, provided that the size of any such sign and the amount of electricity needed to operate and illuminate the same shall be reduced at any time upon direction of the State Fuel Administrator of the state within which such sign is located;

(d) This order **shall not apply to porch lights upon houses or hotels, or at the entrances to buildings occupied or open for ingress or egress during the nighttime, or to lights upon private driveways, walks or in the grounds of any hotel, manufacturing establishment or residence, or upon the platform of railroad stations, approaches thereto or in railroad yards or grounds, or to lights to mark the location of fire escapes or exits, or to lights for any similar purposes when authorized by any State Fuel Administrator** of the state within which such lights are located, provided, however, that the number and power of any such lights by this paragraph (d) permitted shall be reduced at any time upon direction of the State Fuel Administrator of the state within which such buildings or grounds are located;

(e) Nothing herein shall be construed to extend the length of time, fixed by agreement or otherwise, between any person and a State Fuel Administrator for which any such sign or illumination may be displayed or operated.

2. The State Fuel Administrators within the several states are hereby directed and authorized to see that the provisions of this order are observed and carried out within their several states, to report violations thereof to the United States Fuel Administrator, and to recommend to the United States Fuel Administrator action to be taken by him with respect to the sale, shipment, distribution and apportionment of coal to the corporations, associations, partnerships or persons so found to be acting in violation of this order.

H. A. GARFIELD,
United States Fuel Administrator.

November 13, 1917.

THE ABSOLUTE MAXIMUM OF POWER

If we are true friends of freedom—our own or anybody else's—we will see that the power of this country, the productivity of this country, is raised to its absolute maximum and that absolutely nobody is allowed to stand in the way of it.

When I say that nobody is allowed to stand in the way, I don't mean that they shall be prevented by the power of the government, but by the power of American spirit. If we are to do this great thing and show America to be what we believe her to be, the greatest hope and energy of the world, then we must stand together night and day until the job is finished.

Now to "stand together" means that nobody must interrupt the processes of our energy, if the interruption can possibly be avoided without the absolute invasion of freedom. To put it concretely, that means this: Nobody has a right to stop the processes of labor until all the methods of conciliation and settlement have been exhausted; and I might as well say right here that I am not talking to you alone. You sometimes stop the courses of labor, but there are others who do the same. And I believe that I am speaking of my own experience not only, but of the experience of others, when I say that you are reasonable in a larger number of cases than the capitalists.

[From the address of President Wilson before the American Federation of Labor, Buffalo, on Nov. 12.]

ELECTRIC POWER CLUB IN SUCCESSFUL MEETING

Trade Relations, Cost Accounting, Trade Acceptances, and, What Is Now Uppermost, Co-operation with the Government in the War

The Electric Power Club, which now embraces in its membership manufacturers turning out 99 per cent of the motors, transformers and control apparatus of the country, held a very successful meeting on Monday and Tuesday of this week at Hot Springs, Va. Few of the meetings of the club have been so well attended or have had so much of interest for the industry.

Having rounded out in a measure the great work of standardization for which the club was primarily organized, attention is being focused on the larger problems confronting manufacturers involving trade relations, cost accounting, trade acceptances and, what is now uppermost in the minds of all manufacturers, active co-operation with the government in the successful prosecution of the war. It was due to the initiative of the Electric Power Club at its last session at Washington that the Department of Commerce modified its proposed methods of determining costs in letting war orders on a cost plus percentage basis and finally adopted a cost-accounting system more adequate and more in keeping with good commercial practice. In this work the club had the active support of the Electrical Manufacturers' Council.

Scarcity of Labor

The scarcity of labor is a matter of concern to electrical manufacturers as well as to others, and there was free and frank discussion on this subject extending over the two days the club was in session. W. L. Merritt outlined the general trend of developments in the labor market and suggested that a remedy for many difficulties would be forthcoming as soon as there was a greater socialization of labor and employer. Mr. Merritt felt that this could be accomplished through a system of educational publicity. S. L. Nicholson of the Westinghouse Electric & Manufacturing Company read for the information and guidance of the club the report of the National Industrial Conference Board to the Council for National Defense on the labor situation of the country.

The feature of Monday's session, covering as it did the wider outlook for the Electric Power Club, was the presidential address of Clarence L. Collens of Cleveland, Ohio, which will appear in a later issue.

Cost Accounting Favored

The cost-accounting committee of the club in its report showed that the national government does not desire the sale of manufactured goods below cost, quoting freely from the addresses of Edward N. Hurley on that point, but that it is anxious for manufacturers to be conservative and inclusive in ascertaining the cost of producing and selling. Emphasis was placed on the following facts:

1. That ignorance of costs depresses selling values.
2. That lack of uniform accounting induces price cutting.
3. That uniform and conservative cost accounting should prevent selling articles at less than cost.

The committee outlined the relation between costs and accounting, the relation between labor difficulties and profits and the need of adequate cost accounting with any further extension of price regulation by the government. It believes that sufficient reasons existed prior to the war for the adoption by the electrical industry of uniform and conservative cost-accounting systems and that the entry of the United States into the war has brought about conditions which make mandatory the immediate adoption of such cost system. It recommends the installation by the beginning of the year of the cost-accounting system approved by the Electrical Manufacturers' Council, and this recommendation was favorably acted on by the club.

C. E. Patterson of the General Electric Company, who is chairman of the cost-accounting committee, reported on the work of his committee with the representatives of the Department of Commerce since the Electric Power Club meeting in Washington last summer.

An interesting scheme of sales compensation and sales accounting was outlined to the club by Walter Robbins of the Wagner Electric Manufacturing Company on Monday night. In this plan advantage is taken of the selfish interests of sales managers, district managers and salesmen to promote profitable business. In brief, his plan of compensation to sales managers is a fundamental salary payable monthly plus a bonus consisting of a certain percentage of the net profits of the district and payable in a lump sum annually, and a further bonus comprising a lesser percentage of the profits of all offices operating upon this same basis. Many representatives of other manufacturing companies took part in a general discussion of the plan outlined.

War Service Committee

It is the expectation that the manufacturers represented in the Electric Power Club will be called on to assist the government with equipment as the war

progresses, and in order that prompt and effective aid may be rendered the board of governors of the club was constituted a war service committee with power to act in conjunction with a general war committee representing the electrical manufacturing industry. This latter committee will keep in close touch with the newly created electrical division of the finished products section of the War Industries Board of the national government.

Next January the executive members of the club will hold a one-day session in New York City at the time of the war convention of the National Industrial Conference Board.

The meeting closed Tuesday night with reports by various sub-committees of technical standing committees.

TRADE ACCEPTANCES INTEREST ELECTRICAL SUPPLY JOBBERS

Cincinnati Convention Recommends Early Use of This Facility—W. L. Goodwin Talks—Co-operation with the Government

Trade acceptances were the most absorbing topic discussed by the Electrical Supply Jobbers' Association at the regular semi-annual meeting held on Tuesday, Wednesday and Thursday of this week at Cincinnati.

Mr. Du Brul, president of the Miller, Du Brul & Peters Manufacturing Company, Cincinnati, member of the local trade acceptance council, made the chief address, explaining the advantages of trade acceptances to both seller and buyer, especially as a trade stabilizer and as a means for furnishing liquid assets against the excess profits tax due next spring. Great interest was aroused in the proposition as presented by Mr. Du Brul, bringing out a most suggestive discussion on its practical application. At a late session the Supply Jobbers' Association adopted a resolution suggesting that the individual jobber put the use of trade acceptances into practice at the earliest possible moment. Similar action had already been taken by the Atlantic division of the Electrical Supply Jobbers' Association.

The meeting was the best ever held by the Electrical Supply Jobbers' Association in both attendance and interest.

It was the first meeting of the association at which electrical contractors were invited to be present.

Meetings were also held by the central and Atlantic divisions where trade conditions were discussed, growth of small-order business especially receiving attention. In addition reports were made concerning underlying conditions on a new basis of staple electrical supplies.

At the Wednesday morning session W. L. Goodwin explained the plan for harmonizing the various electrical interests, showing the relation between manufacturer, central station, jobber and contractor-dealer in the distribution of merchandise to the ultimate consumer and emphasizing the duty of each to the other. To avoid conflict between the various interests in the industry, Mr. Goodwin suggested preferential discounts in accordance with services performed. He also voiced the need of a code of ethics for the entire industry and the necessity that the three other branches contribute to the development of the contractor-dealer so that the industry may attain maximum efficiency.

The plan was well received, and it is anticipated that individual jobbers will carry out the spirit of the movement in their respective territories.

The supply jobbers are anxious to render all the service they can to the government in the successful prosecution of the war and have empowered their executive committee to offer the resources of any jobber in securing to the various government departments such electrical supplies as are required in any district, believing that such co-operation, particularly in the matter of small quantities, will result in better deliveries and prices to the government.

Considerable interest was displayed throughout the sessions and confidence was expressed in the stability of the jobbing business, although many went to the meeting for the express purpose of exchanging views on the outlook in view of the feeling that gradually as the war progresses the government will demand of industry more and more of its output. The national situation is exercising more influence over local conditions than ever before.

SHORTAGE OF 50,000,000 TONS IN NATION'S COAL SUPPLY

Dr. Garfield Says That Coal Demands of Public Utilities Plants Have Increased by 33 1-3 per Cent

A statement issued this week by Dr. H. A. Garfield, the Fuel Administrator, says that the war needs of the nation for fuel have developed to a point where the demand threatens to outstrip the supply. It says:

Through the efforts of the Fuel Administration and other agencies the annual output of coal has been increased by approximately 50,000,000 tons. But the consumption of coal, it is estimated, has increased by approximately 100,000,000 tons, leaving a gap of 50,000,000 tons to be bridged.

Practically the entire increase in coal consumption is due to the necessities of war. Munitions plants, running twenty-four hours a day at full capacity, with continuous demands from the government for increased production, are using from 33 1/3 to 50 per cent more coal than they were a year ago. For instance, the Bethlehem Steel Company demands an increased coal supply of approximately 250,000 tons a month, or 3,000,000 tons a year.

The direct demands of the government for coal, including the requirements for the actual fighting forces of the army and navy, have increased by 300 per cent. Where 2,000,000 tons supplied the government under normal conditions, the demand is now 8,000,000.

The coal demands of public utilities plants, particularly in the industrial sections of the country, have increased by about 33 1/3 per cent. Practically all of this increase is due to increased power furnished to munitions plants and to other war industries.

To close up the gap of 50,000,000 tons between the production and consumption of coal the Fuel Administration will take steps to increase production, facilitate transportation and enforce the most economical use of the available coal supply. The Fuel Administration is determined that war industries, public utilities and domestic consumers shall be supplied. To this end the co-operation of every coal user of the country will be necessary. The Fuel Administration will use all of its authority to prevent the waste of fuel and the unnecessary use of coal. Domestic consumers will be urged to conserve their supplies.

Wherever the unnecessary use of coal in industry threatens to embarrass war industry the Fuel Administration will see that the war needs are filled. All activities which are unnecessary to the maintenance of economic or military efficiency will have to give way by curtailment to the necessities of war, and this must be accomplished without undue curtailment of the domestic supply.

Handling Labor Problems in Great Britain

Members of Special Mission of the British Ministry of Munitions to the United States Point Out Ways in Which War-Time Problems Affecting Labor Are Met

COMPLETE ADDRESSES ON LABOR PROBLEMS SENT ON REQUEST.—Electrical manufacturers, engineers, central station executives, engineering contractors and other employers of labor who are readers of the ELECTRICAL WORLD will find special interest in the addresses by Sir Stephenson Kent, K. C. B., member of the Council of the Ministry and director general of the labor supply department; H. W. Garrod, deputy assistant secretary of the labor regulation department; G. H. Baillie, chief technical dilution officer of the labor supply department, and Capt. Cyril Asquith, director of the artificers' allocation of the labor supply department, touching upon questions of labor supply, labor shortage, wages and the substitution of women for men in munitions and allied industries of England.

The first three gentlemen addressed a representative body of American engineers at a dinner given in honor of the special mission by the United Engineering Society. The addresses of all four and a summary of the discussion as presented on the same day at a luncheon given in their honor by the editorial conference of the New York Business Publishers' Association have been reprinted by the McGraw-Hill Publishing Company, and the editors of the ELECTRICAL WORLD will be glad to send to any reader interested a copy of the pamphlet containing these important contributions to the solution of our own labor problem.

MEMBERS of the special commission of the British Ministry of Munitions were entertained at luncheon on Tuesday, Nov. 13, by the editorial conference of the New York Business Publishers, Inc., and at a formal dinner in the evening of the same day given by the United Engineering Society.

Sir Stephenson Kent, the chairman of the mission and member of the Council of the Ministry and director general of the labor supply department, in an address before the editors, said in part:

We recognized in England, after our first few months of very bitter experiences, that the organization of a nation's industries on a war basis is even more important than having an army.

My government called together, before the Ministry of Munitions existed, capital and labor—federations of employers and the heads, the executive chiefs, of our trade unions. We differ from you in that respect. The labor that is engaged principally in the engineering trade, in the manufacture of munitions, in its widest sense, is very highly organized. I think it is no exaggeration to say that in the engineering trade 80 per cent of the labor is trade union labor.

My government had two ideal bodies to negotiate with —the committees of these federations of employers, who were fully representative of capital's voice; the trade unions officials, who fully represented labor's voice.

That conference ended in what is known as the treasury agreement. That treasury agreement was embodied in the munitions of war act. The principal features in regard to that act are as follows:

In the first place, the Minister of Munitions definitely had power and definitely limited the profit made in any establishment that was engaged in the manufacture of munitions. In the second place, the wage of the labor in those controlled establishments was fixed.

The committee on production was set up, whose function it was to ascertain what, if any, the increased cost of living amounted to and to issue a national award in regard to that labor whose wage had been fixed, so as to meet the increase in the necessities of life that that labor might find. That committee meets three times in a year and has the necessary statistics laid before it, receives representations from trade unions and from any one else who has a voice or should have a voice in the matter, investigates the case very carefully, then gives instructions that this labor should receive so much extra per week to meet that increased cost.

My government induced—it required very little inducement—the trade union leaders in my country to agree to waive all the restrictive practices that had been common in the manufacture, on the civil side (what now is the munition side), from the point of view of output or of engagement of labor on war work, for the period of the war. On the government's side it pledged itself to restore the pre-war conditions in any factory where by that agreement the normal conditions had been varied.

We take the view that to-day, above all other times, it is absolutely vital to exercise economy from every point of view—economy from the point of view of food—yes; but economy from the point of view of the materials that are essential to the winning of this war, economy from the point of view of the use of man power. We look upon it to-day in England as a very serious crime if steel or copper or lead or iron or any of these raw materials of which we never had a sufficiency is used for any purpose other than to help to win the war. We look upon the misuse by an employer or the army or a government department of the skill of any mechanic or any citizen as really a mistake and a crime and something that it is our duty to put right.

It is absolutely impossible to exaggerate the importance, the overwhelming importance, that labor plays in war. Without labor, without that industrial peace of which I spoke, this war cannot be won. It is the basis of the war. Your man power at the front, your man power at home, all turns on labor's activities and the solution of the problems that war brings in regard to labor.

DILUTION OF LABOR

G. H. Baillie, chief technical dilution officer of the labor supply department and well known as an electrical engineer in England and on the continent, described the two schemes and gave several most interesting examples of how England met the shortage of labor. One scheme is known as the "dilution" of skilled labor with unskilled, and the other the substitution of women for men. Both of these schemes, said Mr. Baillie, were contrary to trade union practice and trade union custom before the war, but were put into effect by mutual agreement as explained by Sir Stephenson Kent. The whole agreement referred to munitions work only. Employers made use of this agreement in several ways:

First, an unskilled worker was brought into the plant to do an easy job. The man so displaced was put on the more skilled work, and the man displaced was again promoted, and so on until there had been an upgrading of skill throughout the whole shop.

Another method adopted was to draw unskilled men from the non-essential trades, unskilled men who were either over military age or of low medical category. Watchmakers were brought into the tool rooms to do gage making. Our building industry was largely closed down, and we took sanitary plumbers from there and trained them up to do lathe turning for our explosive factories. We also drew from the building industry carpenters and joiners and sent them into the shipyards to act as shipwrights and shipjoiners.

We took mechanics, textile mechanics, from the textile industries, accustomed only to rough work, and trained them up to the better work of munitions. A third way was by confining the fully qualified mechanic to the highest forms of skilled work. If the mechanic normally had been

on a job that would be split up into two or more parts of varying degrees of skill, the mechanic was confined to the part requiring the most skill, and we trained up men and women to do the less skilled parts.

Those schemes we called the "dilution of skilled labor," because we made the very little skill we possess go a very long way by diluting it with as much unskilled labor as possible.

But this method fell far short of producing enough workmen, so women were employed. It was agreed that a woman undertaking work which previously had been done by a skilled mechanic should receive the same day rate as the skilled man; if she was on piece work, she was to receive the same piece rate. It was only when she was on unskilled or semi-skilled work that the woman's wage could differ from that of the man, and then her wage was regulated by an order which fixed a minimum wage, a wage, roughly speaking, two-thirds that of the unskilled man.

As a result of the good wages that women have been able to earn on munitions work, we have never been short of applicants for any kind of work, and our employment of women at present is limited only by our facilities for training them. We have now on munitions work only more than a million women.

WORK DONE BY WOMEN

Mr. Baillie outlined several classes of unskilled work successfully done by women, mentioning that in many lines of work 90 per cent was performed by women. Continuing, Mr. Baillie said:

Coming to more highly skilled work, the percentage of women employed is, on the average, a good deal lower. But there are individual cases in which our percentages reach very high figures. We have a shop engaged on breach mechanism for howitzer guns in which every machine tool is operated by women who sit and grind their own tools, and the tools themselves are hardened and ground by women.

H. W. Garrod, deputy assistant secretary of the labor regulation department, speaking to the engineers, pointed out that the war demanded three kinds of sacrifice—sacrifice of life on the battlefield with the world's plaudits and one's own conscience a driving force, sacrifice of wealth with the honor and satisfaction that generosity brings, and sacrifice of prejudice, the most difficult of all. In solving the labor and capital problem Mr. Garrod pointed out that the last sacrifice was the most important and the hardest the war demanded. Mr. Garrod said:

Alone and in his own office the employer may sacrifice to patriotism his prejudices as to his rights, without applause and often against his own class, and similarly the workman in the shop must give up his prejudices. Truly this is an American program.

SKILLED MEN FOR ARMY WORK

Capt. Cyril Asquith, director of the artificers' allocation of the labor supply department, speaking before the editors, said:

Artificer is a name we have in the army for skilled men. It is nothing more or less than a skilled machinist. I think it would probably surprise you to know how large those demands are. The technical branches of the army—that is to say, like the Army Corps, Royal Flying Corps, Royal Engineers, and so on and so forth—compose altogether about half the total number of the armies. I don't say those corps consist wholly of skilled men, but they are filled with them to a greater or to a lesser extent.

Just to give you some notion of the magnitude of the demands which they make, I may mention that as we left England a demand was presented by the War Office for 40,000 skilled men to work on the railways behind the lines in France, and that about three or four weeks ago we heard that a further demand for 15,000 highly skilled machinists had been presented.

We are embarrassed in our attempts to meet those demands by the fact that, in common with practically every other European power, we made the mistake in the first year of the war of permitting the enlistment in infantry and other regiments of highly skilled machinists who would have been much better employed either in civil life upon munitions or in these technical branches of the army to which I refer.

We look to you, gentlemen, to avoid that mistake, and we look to you with the utmost confidence. In fact, we know already that your War Department has taken steps to avoid it. It is about the only mistake we think you should avoid. We have been immensely impressed in the course of our tour with the enormous reservoir of ability and energy and resource which America contains. It gives us high hopes of a certain and not far distant victory.

CAMPAIGN FOR GIFTS FOR ELECTRICAL CHRISTMAS

The Society for Electrical Development Issues a Special Poster as Part of the Movement for the Holiday Season

The Society for Electrical Development, which is planning a nation-wide Christmas gift campaign, has had a special Christmas poster designed. This poster will be available for window displays, store cards,

AN "ELECTRICAL CHRISTMAS" POSTER

poster stamps and window cards. A transparency suitable to the holiday spirit, with special reference to electrical gift suggestions, will be available for windows and doors. A set of special display and price cards have been designed, each card directing attention to the one appliance shown.

A new motion-picture feature has been prepared. Two human-interest scenarios have been produced for the society by the Universal Film Manufacturing Company. The stories show the actual operation of electrical appliances with strong suggestions to "Give something electrical this Christmas."

ACUTE SITUATION OVER NIAGARA POWER SUPPLY

Appointment of Controller of Distribution and Production of Canadian Niagara Energy—American Industries Depend on Canada

Sir Henry Drayton, chairman of the Dominion Railway Commission of Canada, recently appointed royal commissioner to investigate the exportation of Canadian Niagara power to the United States, has been commissioned as controller of the distribution and production of electrical energy in the Province of Ontario.

Vigorous efforts are being made by industries on the American side of the Niagara River to overcome any effort on the part of the Dominion government to place an absolute embargo on the exportation of power. Acting on the suggestion of electric power interests in western New York, Secretary Baker has arranged for a conference between the American and Canadian authorities on the subject.

Former Congressman Robert Bulkley of Cleveland has been designated by the War Department as the American representative. It is expected that the conference will result in the adoption of some sort of a priority arrangement so that if power is cut off from the Canadian side of the river it will not interfere in any way with the manufacture of war supplies for either country. The British war mission, which has been investigating conditions in the United States, was impressed with the necessity for power for American munition factories.

BANKERS STRONGLY URGE WATER-POWER UTILIZATION

Committee on Public Service Securities of Investment Bankers' Association Speaks for Recognition of the Needs of Utilities

A report of the committee on public service securities, presented before the Investment Bankers' Association at Baltimore on Wednesday of this week, calls attention to the incalculable value of water-power development. It says that the regulating commissions have responsibilities which they should meet by allowing utilities to charge rates high enough to develop their plants properly, particularly under the severe conditions during the war crisis and post-war competition. O. B. Willcox, vice-president of Bonbright & Company, New York, is acting chairman of the committee. The report in part follows:

Water powers available on the navigable streams of the country and on the public domain of the United States, of total capacity estimated at 25,000,000 hp. to 50,000,000 hp., are under the jurisdiction of the national government. Development of this asset is impossible under the existing acts of Congress, not so much because of impracticable or unworkable conditions or regulations imposed as because the laws do not permit the acquisition of such title or tenure as will secure the capital necessary for development. The failure of Congress to enact laws encouraging the development of the water powers under the jurisdiction of Congress is due only to ignorance of the value to the nation of the utilization of this undeveloped resource and misconceptions of the conditions required for development occasioned largely by the mistaken arguments of narrow and perverted advocates of what has improperly been called conservation. A mass of impracticable proposals on the subject has been introduced in Congress, further complicating and confusing the subject. Excellent bills have been introduced in both houses providing for the development of national water powers under conditions amply protecting the public interest, but these have invariably been lost in committee. Every banker interested in the welfare of the country must strongly urge upon his senators and representatives in Congress the immediate adoption of a rational policy for the utilization of the power of our rivers and streams, so useless and utterly wasted without development, which if made available would be of incalculable value to the growth of national industry and wealth, particularly at this time when conservation of coal and labor are of the first importance.

ELECTRICITY A GREAT AID IN BUILDING DESTROYER PLANT

Construction of Nine-Million-Dollar Naval Producing Unit at Squantum, Mass., Will Be Rushed with the Help of Electric Service

Electrical construction is proving an important factor in erection of the nine-million-dollar United States destroyer plant of the Fore River Shipbuilding Corporation at Squantum, Mass., near Boston. This essential addition to naval production facilities of the country is enlisting the patriotic co-operation of both utility and contracting interests as well as of the engineering and manufacturing organizations responsible for it.

Energy is being supplied by the Edison Electric Illuminating Company of Boston over a system of temporary lines, including a submarine cable feeding a 4600-volt substation on the site, and at present about 400 kw. in lighting and power service is being utilized. Herbert S. Potter of Boston is fulfilling contracts for all temporary electrical construction at the plant, and all pole line work on the premises, general yard lighting and miscellaneous power work is being installed by his organization. This contractor's force at Squantum now consists of about 100 men, and wiring has been under way for one month. He has received contracts for wiring the plate and angle shop, angle smith shop, assembly building, boiler house and substation. The Lundin Electric & Machine Company of Boston has just been awarded a contract for a twenty-five-panel switchboard to be installed in the substation. The general contractor on the work is the Aberthaw Construction Company of Boston, the consulting engineers being Monks & Johnson, Boston.

Erection of buildings began on Monday of this week. The yards of the destroyer plant are being equipped with a great variety of electrically driven machinery, including concrete mixers, portable band saws, drills and other tools used in rushing the outside work. From a temporary substation on the grounds energy is being distributed for construction purposes by single and three-phase 2300-volt circuits carried on wooden poles. The motors thus far placed in service range from 0.5 hp. to 30 hp. in rating. Grounds and streets are being illuminated by type C gas-filled multiple lamps, usually of 400 watts rating, and interior lighting for construction purposes has been standardized for the present at 100 watts, with gas-filled units. Four lamps per pole is the usual arrangement for outside lighting. Transformers have been loaned by the Boston Edison company to permit rapid installation and early use of tools and building structures, and the Boston Elevated Railway is building a bridge across the Neponset River to provide a cut-off service to the plant with special loop for local use.

Women for Drafting.—The Byllesby engineering department force has been depleted considerably by the entrance of draftsmen into government service. To meet the situation a new policy has been inaugurated of employing women in the drafting room. A start in this direction has been made.

Detroit Edison Company to Authorize Debenture Bonds.—A special meeting of stockholders of the Detroit Edison Company has been called for Nov. 22 to vote on a proposal to authorize $9,000,000 debenture bonds. The company recommends this so that it may have means of providing for its financial needs should occasion arise.

Christmas Boxes for Edison Soldiers.—Electra, an organization of the women employed by the Commonwealth Edison Company of Chicago, is providing a Christmas box this year for each former employee who is now a sailor or soldier. Five hundred and twenty-nine company employees have entered the service to date.

Increase in Electric Rates in England.—The electricity committee of the borough council of Stepney, England, has reported on the further increases necessary in electric rates owing to increased cost of production. Its recommendation has been adopted that, subject to the statutory limitation of charge (an average of 16 cents per unit), all charges made in respect of and relating to electricity supplied to consumers, including meter rentals, except in those cases where there are special contracts, be increased by an additional 16.67 per cent, making a total increase on prewar rates of 50 per cent.

Study of Street Lighting.—Work has been begun by the United States Bureau of Standards on an extensive program of measurements which are designed to furnish first-hand information for use in a street-lighting circular to be issued by the bureau. Among the early features of the work were the measurements made on two types of street arc lamps to determine the distribution of the light and the variation of the candlepower and efficiency with current. The circular in which the results are to be published and which is in the course of preparation is a part of the public utility work of the bureau.

Increase in New Power Customer Rates in Seattle.—The Washington Public Service Commission has granted the Puget Sound Traction, Light & Power Company, Seattle, permission to advance power rates. The advance applies to new power customers, and not to lighting rates. Under the new schedule the minimum rate for 100 hp. or more is increased from 0.5 cent to 1 cent per kilowatt-hour, and the minimum rate for from 21 hp. to 100 hp. is changed from 0.9 cent to 1⅛ cents. The commission approved cancellation of a special rate that had been in effect for some time providing for a reduction of 33 1-3 per cent on all offpeak loads. Other special rates that had been in effect were also cancelled by the order of the commission.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Ohio State University School of Military Aeronautics.—A new building is being erected for the use of the Ohio State University School of Military Aeronautics. This will be used for laboratories and recitation rooms. It is of permanent character and will eventually form part of the Robinson Laboratory, in which are the departments of mechanical and electrical engineering. Immediately east of the Robinson Laboratory a temporary wooden barracks, capable of housing 400 aviation students, is being erected. Several members of the teaching force are participating in the work of this school, which is one of those established by the United States government to train men for the aviation section of the Signal Corps.

Law Against Keeping Explosives.—Any person in the United States found with explosives in his possession in future, and who does not have a license issued by the federal government showing the purpose for which the explosives are to be used, will be arrested at once and fined up to $5,000 or sent to prison for one year. If the circumstances warrant, the person may be fined $5,000 and in addition be sentenced to the year in prison. This is the principal clause in a war measure passed by the last Congress which is now being put into effect by the Bureau of Mines, Department of the Interior, which has been charged with its enforcement. Francis S. Peabody of Chicago has been appointed by Secretary of the Interior Lane to act as assistant to the Director of the Bureau of Mines, Van H. Manning, in enforcement of the law.

"The Nerves of the Army."—The Illinois State Council of Defense has appointed an advisory committee of the electrical industry to determine ways and means by which the members of this industry in Illinois may assist the army, the navy and other government departments. Upon investigating the recruiting situation, as applied to the Signal Corps, this committee has found a need for directing the thought and effort of electrical men toward the Signal Corps. The committee has prepared a Signal Corps folder, "The Nerves of the Army." This is not a call for volunteers. The folder is designed to appeal to the men subject to the draft. The committee is desirous that electrical firms apply for copies of the poster to display on bulletin boards and to forward to male employees between twenty-one and thirty-one years. While this movement as yet has to do entirely with Illinois, it is believed that it will probably become general as its usefulness is appreciated.

Educational Offer to Commonwealth Edison Employees.—The Commonwealth Edison Company of Chicago is making a special offer to 5500 employees in regard to the educational courses offered by the committee on education of salesmen of the Commercial Section of the National Electric Light Association. The circular issued by the company says in part: "Are you aware of the increasing demand for trained men at all times, and particularly at the present time? Are you preparing yourself to take advantage of these increasing opportunities? The company believes in you. Do you believe in yourself? The company backs up this belief in you by the following offers: The company, upon application to the paymaster, will advance to the association the cost of your course, to be paid back to the company by you on the partial payment plan, in accordance with the schedule herein contained. The company agrees to refund to you one-half of the tuition fee upon your presenting a certificate from the association showing satisfactory completion of the course. The Chicago Central Station Institute will conduct, without charge, a monthly class in each of the courses, and will take up and discuss each lesson in its regular order." Fred R. Jenkins states to the ELECTRICAL WORLD that it is expected that a large number of employees will take advantage of these offers and that the benefits will be mutual to the men and the company.

Examination for Officers in Engineer Corps of Naval Reserve Force.—An examination will be held at the Bureau of Yards and Docks, Navy Department, Washington, D. C., to establish a list of eligibles for enrollment in the Civil Engineer Corps of the United States Naval Reserve Force. This examination will close at noon Dec. 31, 1917. A descriptive circular giving detailed information will be sent to interested parties upon request to the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C. The candidate must be an American citizen and an engineer in active practice of the profession of civil, electrical or mechanical engineering or some business directly connected with these professions. The age and experience requirements are: For ensign, not less than twenty-four years of age with not less than two years of active professional practice; for lieutenant (junior grade), not less than twenty-seven years of age with not less than five years of active professional practice; for lieutenant, not less than thirty years of age with not less than seven years of active professional practice, during at least three years of which the candidate must have had responsible charge of work as principal or assistant. Those now in the United States Naval Reserve Force, civilians and any one who is now in the army, either volunteer or drafted, including those directed to appear before an exemption board, may make application, but those in the army, either volunteer or drafted, must obtain their discharge before they can be enrolled.

Chicago Section, A. I. E. E.—The Chicago Section of the Institute will hold a meeting on Nov. 25. Bert H. Peck will present a paper on "Engineering Data for the Determination of an Electric Rate Problem."

Historical Lighting of Independence Square.—E. F. Kingsbury presented a paper on the "Historical Lighting of Independence Square" at a meeting of the Philadelphia Section of the Illuminating Engineering Society on Nov. 16.

San Francisco Jovian League.—At the Nov. 7 meeting of this society, instead of the usual speaker of the day, four speakers gave very brief talks, two on "Co-operation," the third on "How to Play Safe," and the fourth on "What the Inspector Expects." The speakers were C. G. Hardy, city electrician of Oakland; Arthur Kempston, city electrician of San Francisco; John R. Brownell, superintendent of safety, State Accident Commission, and Robert L. Eltringham, safety engineer, State Accident Commission.

Philadelphia Section, A. I. E. E.—William F. Johnson of the Philadelphia Electric Company addressed the Philadelphia Section of the American Institute of Electrical Engineers on Nov. 12 on "Methods of Standardization Employed by a Utility to Insure Accurate and Dependable Means for Determination of Power Distribution and Consumption." At the Nov. 1 meeting of this section W. F. G. Swann, chief of the physical division, department of terrestrial magnetism, Carnegie Institution of Washington, spoke on the subject of "Atmospheric Electricity."

Louisville Jovian League.—Members of the Louisville (Ky.) Jovian League assembled at a luncheon on Oct. 26 to bid farewell to F. V. Gantt, president of the organization. Mr. Gantt for six years has been manager of the Louisville branch of the General Electric Company and is promoted to be the head of the sections handling central station and railway supplies at the division headquarters in Cincinnati, Ohio. A handsomely engraved cigarette case was presented to Mr. Gantt in behalf of the Louisville men. The presidency devolves on Walter S. Clark of the James Clark, Jr., Electric Company, who has been vice-president.

Grand Rally Meeting of the Electrical Men of Greater New York.—The Electrical Contractors' Associations of Greater New York plan to hold a grand rally meeting of all the electrical men of the city and vicinity at the Garden Theater, Madison Avenue and Twenty-seventh Street, New York City, at 8 p. m., Tuesday, Nov. 20. It is expected that from 3000 to 5000 electrical men will attend. The main purpose of the meeting is to launch the "Goodwin plan" of organization for the electrical industry in the metropolitan district. W. L. Goodwin, originator of the "Goodwin plan," will discuss the general subject "Organization." Other well-known men of the electrical industry will address the meeting, among them being James H. McGraw, president of the McGraw-Hill Publishing Company.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Cleveland Section, A. I. E. E.—"Lighting, Its Use in Warfare," is the subject of a meeting to be held on Nov. 19 by the Cleveland Section of the Institute.

Electric Arc Welding.—A. M. Candy presented a paper on "Electric Arc Welding" at a meeting of the Pittsburgh branch of the American Institute of Electrical Engineers held on Nov. 13. The annual banquet will be held Dec. 8.

Jovian Electric League, Los Angeles.—A talk on "The Darkest Days in History," dealing with conditions in Turkey, was made at the Nov. 7 meeting of the Los Angeles Jovian Electric League by J. P. McNaughton, who has just returned to this country after residing in Turkey for twenty-eight years.

Welfare and Efficiency Conference.—The fifth annual Pennsylvania welfare and efficiency conference will be held in the hall of the House of Representatives at Harrisburg on Nov. 21 and 22. These conferences are held annually for the purpose of stimulating discussion on the problems of industry and labor, with especial attention to reducing the vast number of industrial accidents.

Association of Iron and Steel Electrical Engineers.—A joint meeting of the Pittsburgh Section and the Cleveland District Section of the Association of Iron and Steel Electrical Engineers will be held at the Hotel Courtlandt, Canton, Ohio, Nov. 24. Two papers will be presented, the first on "Central Station Power," by W. A. Hornlein, and the second on "Electric Furnaces," by J. D. Donovan.

American Institute of Electrical Engineers.—The three hundred and thirty-fourth meeting of the American Institute of Electrical Engineers was held in the auditorium of the Engineering Societies Building, 33 West Thirty-ninth Street, New York, on Nov. 9. The paper of the evening was entitled "An Experimental Method of Obtaining the Solution of Electrostatic Problems with Notes on High-Voltage Bushing Design," by Chester W. Rice of the General Electric Company.

Pacific Coast Jobbers Meet in Southern California.—The quarterly convention of the Pacific Coast Electrical Supply Jobbers' Association was held at the Beverly Hills Hotel, near Los Angeles, Cal., Oct. 25, 26 and 27. At the open meeting an address was made by Albert H. Elliot outlining the effect which the new federal tax law would have on corporations. An important action taken at the meeting was the appointment of a committee of jobbers' credit men instructed to prepare for submission at the next meeting a report on the credit situation on the Pacific Coast. The committee will give special consideration to trade acceptances, cash discounts and interest on overdue accounts. The next meeting will be the annual convention, held at Del Monte in January.

San Francisco Jovian League Holds Annual Smoker.—The annual smoker and general jollification of the San Francisco Jovian League was held on Nov. 1. To promote the "get-acquainted" movement the program was made up to a large extent of talent from among the membership. There was also a talk on the modern machine gun, together with a demonstration of how its parts are assembled and the gun is served, and an address by Merle Smith, who described the work being done by the army Y. M. C. A. in American training camps and on the European battlefield.

New York Electrical Society.—A joint meeting of the Engineers' Club and the New York Electrical Society was held at the Engineering Societies Building, New York City, on Nov. 15. Lieut.-Col. Ivor Thord-Gray, late in command of the Eleventh Northumberland Fusiliers, British Expeditionary Force, France, gave a short informal talk on "Some Phases of Trench Warfare." After this address Captain P. Corcoran, late in command of the Thirty-seventh Divisional Signal Company, B. E. F., spoke on "Electrical Communication in Modern Warfare." Captain Corcoran gave an illustrated survey of the composition of a modern army, the relative positions of the different units on the battlefield, the different methods of communication between units by radio, by telephone and by telegraph, and the maintenance of connection between the fighting forces and the staff during an engagement.

Electrical Credit Association.—The Electrical Credit Association of Chicago arranged the program to be given at its twenty-second annual meeting at the Hotel La Salle, Nov. 15 and 16, as follows: Reports of officers; reports of territorial chairman; election of officers; address by member of Federal Reserve Board on "Trade Acceptances"; "Effects of War on Collections, Etc.," T. J. Whearty; "Trade Acceptances, Merits and Faults," W. J. Burton; "Business Conditions," E. W. Wolfstyn; "Should Interest Be Charged on Overdue Accounts?" Davis McMakin; "How to Handle Collection Correspondence," J. W. Meriam; "The Necessity for Observance of Terms at This Time," A. T. Bellis; "The Exchange of Trade Information and Credit Losses," open; "Possible Assistance Given Sales Departments by Credit Departments in Securing Desirable Business," W. S. Long; "Passing the Order and Helping Customers, Instead of 'Turning Them Down and Making Them Pay,'" E. T. Martner; "Experience of Members with Customers Called to the Colors," Miss Eva G. Hansen; dinner addresses, "Our Country's Call," by Clarence S. Darrow, and "Some Spiritual Gains of the War," by Horance J. Bridges.

J. D. NICHOLSON

Men of the Industry

Changes in Personnel and Position—Biographical Notes

J. D. Nicholson, the president-elect of the Kansas Public Utilities Association, has been superintendent and manager of the electric property at Newton, Kan., continuously since Dec. 25, 1893. During that period the power plant and distribution system of the company have been rebuilt several times under the direction of Mr. Nicholson. In 1911 the property was sold by him to the Kansas Gas & Electric Company of Wichita. During Mr. Nicholson's service with the Newton company the gross sales for electrical energy have increased from $290 per month in 1893 to $5,500 a month in 1917.

F. T. Morrissey has been transferred from the position of manager of the Duquoin (Ill.) office of the Saline Electric Company to the Eldorado office of the company. Mr. Morrissey will have charge of the company's operations in Eldorado, Ridgway, Equality, Junction City, Shawneetown and Enfield, Ill.

Chester N. Chubb, formerly manager of the Northern Indiana Gas & Electric Company at South Bend, Ind., has been made general manager of the People's Light Company, which operates in Davenport, Buckingham and Bettendorf, Iowa. Prior to going to South Bend Mr. Chubb was vice-president and general manager of the Michigan City (Ind.) plant belonging to the Northern Indiana Gas & Electric Company.

M. S. Sloan has resigned as vice-president and general manager of the New Orleans (La.) Railway & Light Company to become connected with the New York Edison Company as a general aid to Vice-president John W. Lieb. Mr. Sloan is a graduate of the Alabama Polytechnic Institute and from 1906 until late in 1913 was employed by the Birmingham (Ala.) Railway, Light & Power Company. He rose from chief engineer to assistant to the president in 1910, when he assumed supervision over all departments. His first position with the New Orleans property was as assistant to the vice-president. He became manager of the electric and railway properties a few months later and was made vice-president of the company only a few months ago.

Marshall J. Spivery has been transferred from the Eldorado (Ill.) office of the Saline Electric Company to the Duquoin office.

Boyd Hammond, district manager for the Great Western Power Company at Sacramento, Cal., has joined the United States Signal Corps.

B. E. Waltz, president and manager of the Corry City (Pa.) Electric Light Company, has been elected a director of the Corry Board of Commerce.

F. L. Converse, electrical engineer of the Midvale Steel Works, Coatesville, Pa., has resigned to become connected with the Tacony Ordnance Company, Philadelphia.

G. B. Sanford has been transferred from district manager of the Great Western Power Company at Rio Vista to district manager at Sacramento, Cal., succeeding Boyd Hammond, who has joined the United States Signal Corps.

J. R. Murphy, vice-president, manager and contract agent of the Great Bend (Kan.) Water & Electric Company, has resigned. Mr. Murphy went to Great Bend in the latter part of 1912 as manager of the company, having formerly been contract agent and superintendent of the Hoisington (Kan.) Electric & Ice Company. At the same time he was chosen manager of the Hoisington company, but made his headquarters at Great Bend, Kan. A year or more later Mr. Murphy was made vice-president of the Great Bend property.

William E. McClintock, who has been with the National Utilities Company for the last two years as consulting engineer in charge of the reorganization of various gas and electric light properties, will sever his connection with that company about the first of the year and will resume consulting practice, with offices in New York City. Among the properties which Mr. McClintock has reorganized for the National Utilities Company are the Lambertville Public Service Company and the New Hope Electric Company of Lambertville, N. J.; the Newton Gas & Electric Company of Newton, N. J., and the New Jersey Gas & Electric Company of Dover and Wharton, N. J. At the present time he is in Port Arthur, Tex., in temporary charge of the work of reconstruction of the Port Arthur Gas & Power Company. He practiced law in the State of Massachusetts for a number of years before taking up publicity work. Mr. McClintock intends to make a specialty of examinations and reports on utility properties, commission work and reorganizations.

WALTER ROBBINS

Walter Robbins, vice-president of the Wagner Electric Manufacturing Company of St. Louis, has been selected to organize the newly created electrical division of the finished-products section of the War Industries Board. This division will act in an advisory capacity to the various purchasing committees of the government. Mr. Robbins, who is chairman of the transformer committee of the Electric Power Club and one of the most energetic members of the club, will establish himself at Washington soon to take up his new work. Mr. Robbins, who was born in Marquette, Mich., and graduated from the University of Michigan in 1896, was for several years connected with the Western Electric Company in Chicago, entering the employ of the Wagner company in 1905 as assistant general manager and being elected vice-president in 1915. He took a leading part in the formation of the League of Electrical Interests of St. Louis.

E. A. Wright, manager and contract agent of the Manhattan (Kan.) Ice, Light & Power Company, has been appointed successor to J. R. Murphy as manager of the Great Bend (Kan.) Water & Electric Company and the Hoisington Electric & Ice Company. Mr. Wright is a graduate electrical engineer and was for several years in the engineering department of the Allis-Chalmers Company, Norwood, Ohio, which position he resigned to become manager of the Manhattan properties in 1912.

Obituary

John M. Winslow, one of the pioneer telephone builders of the State of Washington, recently died at his country home near Silver Lake, at the age of sixty-one years. Mr. Winslow was born in Philadelphia. As a civil engineer he was engaged for a number of years in Mexico. Going to the Pacific Northwest, he settled in Tacoma, and fifteen years ago he went to Seattle to reside. He held the position of secretary-treasurer of the Puget Sound Telephone Company and was active in the company's affairs up to the time of his death.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

AMALGAMATION OF LARGE HEATING-DEVICE INTERESTS

Edison Electric Appliance Company to Be Formed to Acquire Domestic Electric Heating-Device Business of Three Companies

Three of the largest manufacturers of domestic electric heating devices have consolidated their interests into one company to be known as the Edison Electric Appliance Company. This company will be organized to acquire the domestic electric heating-device business of the General Electric Company, the Hotpoint Electric Heating Company and the Hughes Electric Heating Company.

The purpose of this amalgamation is to secure a large volume of production of domestic electric heating devices and also more standardized designs. The new company, it is felt by the organizers, will also be able to secure more complete and thorough distribution of its output than could be done by the individual companies acting separately.

The new company will be licensed under the Marsh patent to use nickel-chromium in its resistance units.

W. H. Booth of the Hotpoint company will be chairman of the boards of the new company, and George Hughes of the Hughes company will be president. A. K. Baylor and H. C. Houck of the General Electric Company will be on the board of directors. Mr. Richardson and Percy Booth, both of the Hotpoint company, will be associated with the manufacturing and commercial departments of the new company respectively. An announcement of the capitalization of the new company will be made at a later date.

For the time being the new company will use the factories of the Hotpoint company at Ontario, Cal., and the Hughes company at Chicago. The domestic heating-device manufactures of the General Electric Company will be moved from Pittsfield, Mass., to the new factories.

THIS YEAR A BIG ONE FOR EASTERN SUPPLY JOBBERS

Although Building Construction Has Fallen Off Almost to a Minimum, Other Business Continues in Considerable Volume

Notwithstanding the extraordinary slump throughout the territory in and about New York City in building operations, which almost closes an important sales outlet, jobbing houses are having a volume of business quite surprising. One firm's branches in Brooklyn and the Bronx, specializing for building contractors, are almost at a standstill. The high prices and intermittent delivery of goods from the factories in no wise dampen the spirit of the progressive members of the trade. Leading concerns testify cheerfully to these facts, fortifying their statements in some instances by the declaration that it is the best selling year since the breaking out of the European war.

Obtaining stocks is the main trouble, but even at that the fact of having more orders on their books, from dealers of unassailable credit standing, is a source of satisfaction all around. Next to the difficulty of accumulating stock of any considerable size, the price situation is an ever-disturbing element with jobbers figuring on contracts or future quotations to dealers. Prominent houses are of the opinion that the peak has been reached, and that prices will remain on that level for some time to come. Freights are bothersome, being slow and uncertain, and the difficulty of arranging for material on a definite basis is causing anxiety among those jobbers who are also manufacturers. This contingent is likewise face to face with the labor scarcity.

Shortages more or less acute are reported in lamps of all sizes, deliveries being back from six to eight weeks. This is accounted for by the factories being short-handed. In fact, this is true of all forms of glass used in the electrical trade. There is a fair supply of sockets with some jobbers and a dearth with others. Wire is hard to buy in any quantity. Manufacturers advise the jobbing establishments that this condition will continue indefinitely unless the governmental embargo goes off on copper. On these specialties orders have been accepted and filed subject to future developments at the factory end. Briefly, orders for almost anything in staples from dealers may be had for the asking, and not infrequently they are thrust upon the none too willing jobber in a quandary as to how the merchandise in question is to be corralled.

Jobbers in this section are, as a rule, very much interested in the so-called Goodwin movement. Many are of the belief that a great many, if not the entire train, of so-called evils from which both they and the dealers suffer will take wings and fly away when this effort to concentrate and consolidate the trade is finally consummated. An important "rally meeting" of contractors, jobbers and dealers, to further the welfare of buyer and seller, is to be held at the Garden Theater, New York City, during the evening of Nov. 20. As one jobber, in referring to the event in anticipation, said, "it will be the biggest thing ever pulled off."

THE ASBESTOS MARKET SITUATION IMPROVING

Prices Are Generally Lower than Last Year, While Production Has Caught Up with Demand in Some Lines of Material

Asbestos in the various forms employed by the trade is and has been for some time, as a market proposition, in an unsettled condition. Prices are up and down, but as a rule are on a lower scale than a year ago. Changes have occurred in the meantime, and in some instances the advances are sharp. Deliveries are reported as good as might be expected under the present abnormal circumstances, but few delays of over two weeks are heard of, according to the shippers—including jobbers, distributers and manufacturers. When shipments fail to reach destination at a later date than prescribed, freight congestion, which is a nightmare to many, is blamed for non-deliveries.

The situation is improving, though governmental commitments, which are given primary consideration at every stage, have interfered with the prompt attention usually accorded orders from private sources. The demand has greatly increased, and a wider use is found for stock or standard goods. The call for specialties to meet specified requirements is also expanding in a marked degree. Recently business has been caught up with in some lines, orders have been filled and shipment completed, and the future, an unknown quantity in several respects, is now being considered. Labor troubles are a factor of importance, but the visible supply of material seems to be ample.

Listing or woven tape, 0.015 grade, is selling for from $4 to $6 a pound, according to deliveries, the latter being figured as a controlling condition. Asbestos paper for fireproofing and switch boxes, formerly quoted at 4 cents a pound, is now 13 cents, with a strong stock available. Tubing, flexible and rigid, commands a special price, dependent upon diameter and quantity, ranging from $2.85 to $3 a pound. This represents an advance of 100 per cent

as against normal figures. One manufacturer says that former prices under old contracts with jobbers still govern; otherwise current figures, which are subject to change, prevail.

AN ADVERTISING POLICY WHICH IS BROAD-MINDED

Lamp Manufacturer Preparing Books on Industrial Lighting to Overcome Indifference on the General Subject of Illumination

A new plan of advertising of broad character has been adopted by the Westinghouse Lamp Company in its industrial lighting campaign. Believing that its advertising problem is not to sell an industrial plant manager Westinghouse lamps, but rather to overcome his indifference on the general subject of lighting, the company has had two books prepared and has in the course of preparation others in which lighting is almost a secondary consideration. In these books the problems of the industrial plant manager are treated, showing the relation of good lighting to them.

Each volume takes up a different class, with the exception perhaps of the first one, by Harry Franklin Porter, entitled "Successful Industrial Management," in which the problems of the general industrial field are considered from the standpoint of the executive, manager and superintendent. Other volumes will take up particular industries. Thus there has already been printed a volume entitled "Increasing and Improving Production," by R. T. Kent, devoted to the metal-working field, and there will shortly be available a volume on textile mills. These books are each compiled by a recognized authority in his own field, thus giving to each volume a stamp of value.

This policy, tried as an experiment, is now believed by the company to be a success. Within two months after the first announcement there were 750 direct requests for the metal-working book and 1000 for the general book.

METAL MARKET SITUATION

Copper a Bone of Contention on Price—Holders in a Peculiar Position with Government as Arbiter

Differences of opinion exist between the manufacturers, jobbers of finished goods and producers of copper. A number of the former, prominent companies, are inclined to believe there is a reserve stock of the metal being held for still higher premium prices than are occasionally quoted. Producers and statisticians emphatically declare a shortage is in sight and that no relief is to be expected until spring. Holders of copper are not openly offering it because of the fixed official price, and even if a high figure is proffered by a manufacturer in order to fill a contract it is difficult to obtain the needed supply. Dealers are receiving the copper they bought earlier in the year, for which the contract price ranges from 25 to 29 cents, but they have been authoritatively instructed not to sell at a higher price than 23.50. Very few changes have been made in other metals. Aluminum, tin, brass and lead are higher.

NEW YORK METAL MARKET PRICES

	Nov. 5	Nov. 12
	£ s d	£ s d
Copper:		
London standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	30.00 to 31.00	30.00 to 31.00*
Lead, trust price	6.00	5.50
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	7.67½	7.50 to 8.05
Tin, Straits	68.00	71.00
Aluminum, 98 to 99 per cent	33.00 to 35.00	34.00 to 36.00

OLD METALS

Heavy copper and wire	21.50 to 22.50	22.00 to 22.50
Brass, heavy	14.00 to 16.00	14.15 to 16.00
Brass, light	10.50 to 11.00	10.50 to 11.25
Lead, heavy	5.00 to 5.25	5.25 to 5.75
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

WITH the exception of the Pacific Coast region no marked effect is observable in the curtailment of buying on account of the recent regrettable war reverses in Italy and Russia. Inquiries from the Orient are noted, with Japan an important factor. Shipbuilding enterprises in the Northwest Coast States present new developments on a large scale. The demand for electrical apparatus, appliances and supplies is so large in consequence that the shortage is causing uneasiness in the trade. Conduit and lighting fixtures are becoming scarce, with deliveries continuing uncertain. In the Middle West the sale of supplies is restricted on account of the low ebb in building operations; otherwise the buying is normal, if not active. In the East labor troubles are paramount, but business is quite satisfactory. Conditions in the South show a steady increase in the buying of staples and holiday goods of utility rather than mere novelties.

Collections are on a firm basis, with credits being carefully scrutinized. In some quarters there is a disposition to take up with the authorities the "red-tape" delays which at times occur in connection with the settlement of bills for work for the Government.

NEW YORK

Labor shortage, especially of skilled factory workers, is having a marked effect in every line, being reflected concretely in threatened further delivery delays and probably advanced prices on some classes of electrical merchandise. It is the general opinion, however, that prices have reached peak and will remain there for some time, with recessions a remote possibility.

With the curtailment in the supply of the main lines, jobbers and dealers are stocking generously on household specialties, heating appliances and holiday goods. Trade promises to be far above last year's record in this particular.

Collections are followed with assiduity and success, and credits are closely looked after.

COLLECTIONS.—Manufacturers are looking after collections closer than for years. The usual sixty days' dating allowed established jobbers is still in vogue, but a 5 per cent discount for spot cash is promptly accepted in settlement of bills. Credits with the smaller jobbers and contractors are tightening appreciably.

LAMPS.—A shortage is reported in 10-watt and 220-watt nitrogen lamps, the latter being called for by the War Industries Board. Deliveries are behind sixty days and longer with other types. A curtailment in the supply of bulbs, bowls and globes may also account to some extent for this condition, as blowers and other skilled operatives are needed.

INSULATING PAPER.—In common with other products prices on insulating papers and fabrics have been advancing from time to time. Material which at one time cost 7 cents a pound is now selling above 50 cents; other basic constituents have jumped up 100 to 200 per cent. On account of an accumulation of stock deliveries are quite satisfactory.

FANS.—Distributers and jobbers are now figuring on the supply of fans for 1918. The new prices are usually ready early in December, if not sooner. Manufacturers are hampered by the outlook for brass, and a liberal output is problematical. With the recollection of last summer's acute shortage jobbers and dealers will make every effort to secure all the fans possible. A sharp advance is anticipated.

HEATING SPECIALTIES.—A liberal inquiry continues for heating appliances, percolators, chafing dishes, etc., and other specialties, but in all these lines complaint is heard from dealers regarding the difficulty of obtaining supplies in satisfactory quantity. The jobbing houses are preparing for a large volume of business, and heavy orders are awaiting delivery, merchandise going out as rapidly as received. No further price advance is looked for prior to Jan. 1.

LABOR.—In every quarter the growing scarcity of skilled workmen is the cause of more than passing uneasiness. With the large distributers of electrical goods, not to mention the manufacturers, the loss of many experienced heads of departments has necessitated "doubling up" and extra hours to enable the concerns affected to keep abreast of orders. At the factories the situation is acute. For instance, one of the large electrical manufacturing companies reports that its complement of skilled workers is far from being full. The company would put on 10,000 additional men at one of its plants if they could be had. The equipment of the same concern's new factories, which are to begin operation shortly, is a difficult undertaking in respect to obtaining a sufficient working force. Conditions are far more serious in the East than in the Middle West.

MOTORS, ETC.—There is an improvement in the delivery of small motors, but that certain sizes of generators or transformers may be figured on a definite basis is purely conjecture. That the situation is bettering is freely believed locally. It is frankly admitted, however, that the main disturbance now is the growing shortage of labor—it is everywhere in evidence. Further, the force at work is improving every chance, in view of the lack of men, to make fresh demands of one sort or another. This is becoming decidedly embarrassing and perplexing when it comes to figuring factory costs and deliveries.

CHICAGO

There is not much change in the general business situation in the Chicago territory. In the building line residential construction has been dead and gives no evidence of reviving. The industrial demand continues strong. Just at this time of the year there is always some expansion in the trade due to the fact that this is the fall lighting season, and this normal expansion is at present noticeable in just about the amount which was anticipated. So, while business is somewhat better this month than it has been, this cannot be taken to mean that business is getting markedly better, but rather should be interpreted as indicating that the normal expansion due to the season is at hand. Jobbers report that the adverse war news of the last few weeks has had little noticeable effect on buyers. The trade which patronizes jobbers does not keep its finger on the pulse of Wall Street so closely as do other people in the trade.

COPPER WIRE.—Rubber-covered copper wire is holding steady on a 35-cent base. The wire is hard to get and the demand is good. The jobbers cannot get wire at a price which will let them sell lower than 35-cent base.

CONDUIT.—There is little activity in the conduit field at present. Conduit, especially of the larger size, is difficult to get, owing to the demand made upon the mills for merchant pipe of the larger sizes. There is no indication of a decline in prices, because of the fact that the mills can make more money by selling merchant pipe than by treating it and selling it as conduit.

PORCELAIN INSULATORS.—In some respects the insulator situation is somewhat better than it was six months ago, although this cannot be taken as a sweeping statement. On the 33,000-volt pin-type insulators the manufacturers are still "up against it" to make deliveries. On the suspension type there are probably enough orders booked to run the mills for four or five months, but it is possible for a rush order to receive more prompt attention if it calls for this type of equipment. Orders for immediate delivery are off just now, owing to the season, but booking orders are coming in in good shape. Some of the mills have experienced a little difficulty, due to the early cold weather, which cut off the gas supply at a time when it was difficult to buy coal. The situation as regards malleable castings which go into insulators has eased up considerably.

AUTOMOBILE HEATERS.—The early cold weather has given automobile heater manufacturers an opportunity of doing a good business in these devices this year. The articles were widely advertised in the United States and Canada, but last year's sales were not up to expectations on account of the warm fall weather. Expectations for this season are high.

BOSTON

Business activity remains at a high pitch in the Northeast, and in most lines of electrical interest trade is brisk. The flood of government orders shows little sign of abatement. Collections are a little slow, especially in the contracting field. Credits are not improving, but the situation is not very disquieting as yet, the fundamental soundness of the electrical industry being as plain under war conditions as could be asked. Prices are firm and high, costs away up, but the public is meeting the situation with courage and determination to see the war through to a successful finish. High-class buying is much in evidence, notably in the latest Oriental styles of portable lamps. Storage batteries are in very heavy demand, and vacuum cleaners are moving well. Central station power business is very large, especially in the munitions field, there being no signs of curtailment to be found here. Labor troubles are disturbing, but the President's speech at Buffalo Monday will have a good effect upon the rank and file of the workers, who are unquestionably patriotic at heart. Uncertainty is growing as to the effect of the Western Electric strike at South Boston, which still continues, upon the maintenance of satisfactory telephone service in the Boston district.

APPLIANCES.—Increasing interest is seen in portable lamps, especially of the new Oriental styles, high cost apparently being no argument against purchase. Low-priced portables of this class are also moving faster, and the prospects for the holiday trade are excellent. At the moment other appliances appear to be in reasonable demand; but, unless vacuum cleaners and washing machines are excepted, no special boom is to be seen.

STORAGE BATTERIES.—Stocks are almost exhausted in the alkali type, and deliveries are in excess of normal on the lead type, though customers are being cared for very well, thanks to factory enlargements and the foresight of distributers. The demand, especially from government or related sources, is enormous. Prices are steady. The recent upward turn in lead is not expected to attain the former maximum.

ARC LAMPS.—The demand is substantial, although nothing in the way of a boom is being handled. Floodlight business is excellent, although below the rush of late spring. Factory stocks are accumulating for immediate shipments, and there is some prospect of a future increase in prices, according to current opinion.

INCANDESCENT LAMPS.—Complaints as to scarcity are rife among the smaller dealers and jobbers. The larger dealers are unable in many cases to obtain deliveries in large quantities at present, a fairly strict control being exercised at the factories on production and shipments. It is a poor time to insist on special lamps if early delivery is desired.

SOCKETS.—A heavy demand is noted for shipyard service and for mill use. On a recent large order the manufacturer is to make immediate shipment of 50 per cent of the number required, balance in two weeks.

ELECTRIC SIGNS.—New business has been dull for several months, and the fuel-saving restrictions, which went into effect Monday, have produced little effect on the trade as yet. Low-wattage lamps, of course, will be somewhat more plentiful if the restrictions remain in force many months.

CONDUIT.—Jobbers' stocks are about as full as six or eight weeks ago, and a fair supply of smaller sizes is coming in up to 0.5-in.; but 1-in. conduit and over is difficult to obtain. A fair delivery is reported on a former order, but in the main deliveries are unsatisfactory.

ATLANTA

Business continues good, and there has been virtually no change in general conditions during the past week. The demand for all goods in the jobbing line is steady, with a slight increase in the volume of sales covering a few specialties.

Jobbers are placing more substantial orders than they did during the previous four or five weeks. This is due, no doubt, to the fact that the buying element realizes that no material reduction in price, if any, can be expected on steel

products for some time. On the whole, the jobbers are in good shape, and their financial position is getting better every day. They report collections as being excellent, showing an improvement over last month.

Inquiries and the demand for electric signs have been very strong up to the present, but this line is bound to suffer if final approval is given to the order turning off all signs for the duration of the war. As the movement is directed at this time only at the source of energy supplied by coal and coke, it is not definitely known what the fate will be of signs served from hydroelectric sources; but from information at hand it appears that Fuel Administrator Garfield has no intention, at least for the present, of dimming signs fed by hydroelectric power, unless the coal-saving order is followed by another having as its object the saving of energy to be used industrially.

The Southeastern States, then, are fortunately situated to the extent that their large centers of population, it is hoped, will not be affected, inasmuch as the cities of Atlanta, Augusta, Columbus and Macon, Ga.; Birmingham, Ala.; Nashville, Knoxville and Chattanooga, Tenn.; Charlotte, N. C., and many others are served from interconnecting transmission systems supplied from hydroelectric plants.

FIXTURES.—Jobbers handling this line report a very heavy business covering the entire Southeastern States. In addition to the normal demand a big market is opening up in the rural districts, where farm lighting outfits are being sold. The most popular demand from this source seems to be for the standard shower-type fixture. Activity in apartment and residence building is picking up in Atlanta's burned section, and especially in those cities where camps are located. This has favorably affected fixture sales, and an unprecedented demand has been created for all types. A comparison of orders filled for shipment to the larger cities indicates a strong leaning toward the semi-indirect and candelabra type. The lack of labor for assembling and hanging, also the slowing up in deliveries, has kept the dealers from making even larger sales.

METERS.—The demand for single and polyphase meters continues steady. Manufacturers are giving comparatively prompt deliveries on the single-phase type and report an improvement in deliveries on the polyphase.

TRANSFORMERS.—One manufacturer reports a marked improvement on the delivery of standard 2300-volt distributing-type transformers up to 25 kva.

SEATTLE

The electrical jobbers of Seattle report a noticeable increase in buying along some lines. During the week five to twelve of the biggest increases emanated from the Puget Sound Navy Yard, Bremerton, and other government sources. These orders and the demand for the shipyards are rapidly causing a shortage, which exists and is expected to become more pronounced. Range business and sales of energy-consuming devices have dropped off slightly, owing, it is believed, to the approaching holiday buying. These lines are expected to sell heavily in the weeks preceding Christmas, and dealers have planned accordingly. Shortages in materials and equipment mentioned in the last two dispatches still obtain, with no signs of abatement. Conduit shipments are coming through about the same, and the lowness of stocks in this particular line is causing some worry. Government demands for conduit are increasing. Freight conditions are about the same as last week. Prices steady.

The Seattle school board will shortly let a contract for motors and transmission apparatus to be used in the manual-training centers. The week was featured by a letting of contracts to general contractors in the Northwest for cantonment buildings at Fort Worden, Casey and Flagler, in the Puget Sound coast artillery district, involving about fifty buildings. The contract for a building for an amusement zone at the American Lake cantonment involves 300 buildings and the expenditure of $1,500,000. A complete lighting system for the zone is also included in this contract. Local dealers expect considerable business in the sale of lighting equipment from the above contracts.

Two Seattle shipyards were incorporated last week for the construction of steel ships, involving an expenditure of $32,000,000. The deal is the largest awarded to any concern in the Northwest and adds the sixth steel shipyard to the Seattle industry, involving an immediate expansion of the well-established plants. It is understood locally that the contracts for the major portion of the steel and equipment to be used in this steel ship construction enterprise have been awarded to Eastern concerns. However, local jobbers are making arrangements to care for the large increase in business expected from shipbuilding sources next year. The increase in the demand for electrical equipment in the cities, excepting Tacoma, is at a decidedly low ebb. Portland reports show that the cost of building is more than 42 per cent higher than last year. It is believed that these figures will apply to other large cities in this section.

The settlement of the strike in the shipyards at Olympia has been effected. The workers are promised a raise in wages dating back to Aug. 1. Other points at issue will be arbitrated. President Wilson's mediation board, which is handling the adjustment of the strike of the employees of the Pacific Telephone & Telegraph Company in Oregon and Washington, is expected to arrive shortly to treat directly with the employees. In the meantime the telephone service in Seattle and other Northwestern cities remains demoralized, with no signs of improvement.

The lumber production for the week was within 15 per cent of normal, with orders keeping pace. A shortage of logs is feared.

SAN FRANCISCO

The reverses along the Italian line have brought conviction of a longer war period, and with this has come a readjustment of affairs in accordance with that view. Equipment and supply orders that have been held under advisement have been released or canceled, according as they deal with the production of war supplies or business depressed by the war. War conditions have made burdensome the low light and power rates common in the West, and a very general effort toward relief is being made. The California Railroad Commission's annual report, just issued, says: "The increasingly large number of applications by the public utilities for authority to increase rates is based on increases in prices of labor, fuel, oil, materials and supplies." Labor and fuel-oil prices particularly have absorbed the funds of smaller companies that would normally go into other channels. To a considerable extent, therefore, the market is affected by rate readjustments.

The Oriental market is undergoing changes of much interest, although under present conditions there is little opportunity for this country to profit from trade opportunities there. From Japan and insular and mainland territories of the Orient generally comes a strong demand for electrical supplies of all kinds, caused by a desire to extend industrial plants and increase productions. This business has to be refused. For example, Australian wheat now comes here for milling and has to be transshipped to England because Australian mills cannot get the equipment to increase their capacity. Japan is making strenuous efforts to supply Oriental markets and has been filling large orders for electrical supplies in India and Russia. Very recently a quotation of nine months' delivery was made by an American manufacturer of 100,000 ft. of No. 18 lamp cord for Russia. The order was secured by a Japanese factory, which promised delivery in ninety days.

LAMPS.—The local manufacturing capacity plus the receipt of Eastern shipments is just sufficient to supply the demand for lamps; and even this condition is maintained only by the careful scrutiny of orders, rejecting or postponing delivery on those where lamps are not actually needed at once.

PROJECTORS.—Floodlighting projectors are moving more rapidly. Many government orders are being received. Recent Italian war news seems to have released orders on floodlighting equipment previously held for consideration.

ELECTRICAL RANGES.—Prospects for next year's range sales are already spoken of as unusually good, provided that the companies can then supply the power. The increasing price of other fuel is directing attention effectively toward the electric kitchens.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.& S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single Conductor

No. 14 Solid
Less than coil.....List net to $61.00
Coil to 1000 ft.....—5% to $59.17

No. 12 Solid
Less than coil.....List net to $71.00
Coil to 1000 ft.....—15% to $68.87

Twin-Conductor

No. 14 Solid
Less than coil.....List net to $105.00
Coil to 1000 ft.....$70.00 to 10%

No. 12 Solid
Less than coil.....List net to $135.00
Coil to 1000 ft.....—10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....+10%
Coil to 1000 ft.....—10%

Twin-Conductor

Less than coil.....+10%
Coil to 1000 ft.....—10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....10% to list net
1/5 to std. pkg.....15% to 20%
Std. pkg.....28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....+20% to 12%
1/5 to std. pkg.....List to 20%
Std. pkg.....28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.31 to .32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31 to .3175	.32 to .3275
Barrel lots	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	$75.00	$66.00 to $69.75
3/8-in. d. stp.	75.00 to 78.75	68.25 to 72.00
1/2-in. s. stp.	100.00	88.00 to 93.00
1/2-in. d. stp.	100.00 to 105.00	91.00 to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.75
3/8-in. double strip	78.75	71.25-71.75
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
5/16	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—		
$25.00-$55.00	$20.50-$24.75	$20.00-$22.00
1/4-in.—		
$28.00-$60.00	$22.50-$27.00	$22.00-$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—		
$36.69-$55.00	$27.50	$24.75
1/4-in.—		
$40.00-$60.00	$30.00	$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.60
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 6%	7% to 9%
2500 to 5000 lb.	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	3.4% to 4.8%	6.4% to 7.8%
2500-5000 lb.	5.4% to 6.8%	8.4% to 9.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....$5.00 to $6.00
Discount.....25% to 30%

CHICAGO

List.....$5.00 to $6.00
Discount.....25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List. Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4¾ in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$36.24 to $36.56
Coil to 1000 ft.	27.18 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.00 to $25.75

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S	30.00
103—C.A., 9, 4R. B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	20% to 37%	25% to 32%
$10.00 to $50.00 list	30% to 45%	20% to 40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.00 to $38.00
1/5 to std. pkg.	13.60 to 19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $20.54
1/5 to std. pkg.	14.80 to 19.24

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$20.00 to $29.00	$23.20 to $30.75
1/5 to std. pkg.	13.50 to 15.60	18.70 to 24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List net to + 5%
$10 to $25 list	Net to 11%
$25 to $50 list	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	10% to 16%
$25 to $50 list	14% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+5%
$10 to $25 list	—11%
$25 to $50 list	—14%
	Low Grade
Less than $10 list	—5%
$10 to $25 list	—16%
$25 to $50 list	—24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to net
1/5 to std. pkg.	Net to —15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List to list net	List net to + 10%
$2.00 to $10.00 list	10% to 20%	5% to 10%
$10.00 to $50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 50%	20% to 40%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $7.50
Discount	25% to 30%

CHICAGO

List price	$4.50 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.44¼ to $0.65
No. 18, full spools	0.43¼ to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.57½ to $0.65
No. 18, full spools	0.50½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11	$15.00-$18.00	$13.00-$14.00	$11.25-$12.00
12	23.25- 27.09	21.30- 23.22	19.35- 20.85
10	32.40- 37.80	29.70- 32.40	27.00- 29.25
8	45.70- 53.34	41.90- 45.73	38.00- 41.38
6	72.40- 84.42	66.35- 72.40	60.30- 65.50

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$13.50	$12.00
12	25.21-27.37	21.30-27.37	17.40-23.46
10	35.29-38.25	29.82-32.72	24.35-30.60
8	49.91-54.27	42.18-46.43	34.45-43 42
6	78.95-92.61	60.85-79.23	51.15-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.25 to $40.00
25 to 50 lb.	35.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$40.00 to $40.50
25 to 50 lb.	39.00 to 39.50
50 to 100 lb.	38.00 to 38.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Expansion Joint for Copper Busbars

To forestall the difficulties arising from busbar expansion one of the manufacturers has produced an expansion joint identical in principle with that previously made up and used by

LARGE-SIZE EXPANSION JOINT

several companies. These joints bolt into the bus and impose no poor connection or reduction of bar stack conductivity. These elements are furnished for stacks of any number of bars of all the bar sizes and spacings common to present practice. The conductivity of the joint is equal to or greater than that of the bar stack which it joins and is very flexible because of its thorough lamination, it is pointed out.

These joints are produced in all sizes by the General Devices & Fittings Company of Chicago.

Dead-Front Panel Switches

The Bryant Electric Company of Bridgeport, Conn., announces an addition to its line of dead-front panel switches. Devices of this character, both in the rotary and push-button types, have been in use for some time. These, however, have been fitted with connections for plug fuses. Now, where the conditions do not permit of the use of plug fuses, as, for instance, on circuits above 125 volts, a Bryant panel unit can be had with connections for cartridge fuses.

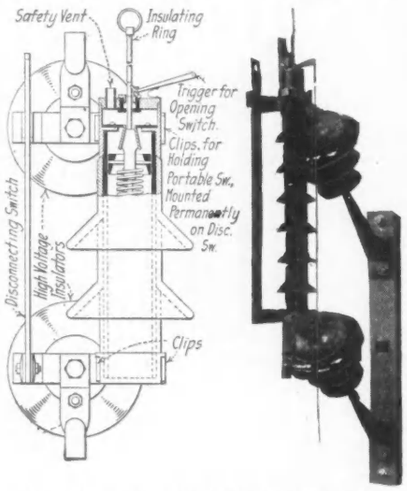
Each unit is complete in itself, consisting of a substantial porcelain base, upon which are mounted two demount-

EACH UNIT IS COMPLETE IN ITSELF

able switch mechanisms with fuse connections, all ready for connecting to the circuits. Aside from the feature of convenience, the method of affording safety against shock to the operator is pointed out. The entire front of each unit is fully protected by substantial sheet fiber. This effectively covers and protects all live parts so that it is impossible for a careless or thoughtless operator to "get a shock," it is claimed.

Portable High-Voltage Switch

A portable high-voltage switch, which consists essentially of circuit-breaking contacts, opened by a strong coil spring and inclosed in an insulating tube filled with an arc-extinguishing dielectric liquid, is shown herewith. The switch is held in a closed position, against the pull of the spring, by means of a catch at the top. When this catch is tripped by a string or rod the contacts are disengaged, and the spring pulls the lower contact down into the



MAY BE USED INDOORS OR OUTDOORS

liquid, which is forced on the moving terminal by means of the liquid director immediately below the moving contact. The switch is placed in special clips mounted on the disconnecting switch by means of a special insulating pole. The pole is provided with two hooks which engage bales on the upper and lower terminals fitted to the insulating tube. When the unit is used as a portable switch it is closed manually by means of an insulating rod fastened to the moving terminal and extending through the top of the switch. In places where the switch would be operated frequently—that is, once a day or once every few days—and where the expense of a permanent installation is warranted, a similar unit is installed and is provided with two sets of strings or cords, so that it can be both closed and opened without removing it from the contact clips.

In permanent installations automatic operation on overloads can be obtained by means of primary relays or a special arrangement of fuses. When the switches are permanently installed and are equipped for automatic operation in outdoor installations the mechanism at the top is protected from snow, ice and sleet by means of a simple shelter.

These switches, for either portable or permanent installations, can be furnished for all voltages from 2000 to 110,000. They can be used indoors or outdoors, on pole tops or in manholes. The switches are rugged, light and simple, all of which tends to reliable service, it is pointed out. They are manufactured by Schweitzer & Conrad, Inc., 4431-39 Ravenswood Avenue, Chicago.

Globe and Refractor

A glass globe and an improved Holophane refractor have recently been added to the General Electric Novalux street-lighting fixtures. The new Holophane dome refractor, of corrugated glass, collects more upward light than other designs and throws this light downward and out into the street at an angle of 10 deg. below the horizontal. It practically does away with a reflector and makes the lamp far more efficient, it is pointed out.

The glass globe also added to this Novalux fixture is of clear glass stippled on the inside. It diffuses the light over a large area and at the same time absorbs very little more light than a clear globe. The globe also eliminates any dazzling point of light, producing a glowing effect that spreads a flood of light evenly over the street.

This fixture, made by the General

ELIMINATES ANY DAZZLING POINT OF LIGHT

Electric Company of Schenectady, N. Y., with the stippled globe and dome reflector, takes the gas-filled type C tungsten lamps in all sizes from 250 cp. to 1000 cp.

Washing-Machine Motor

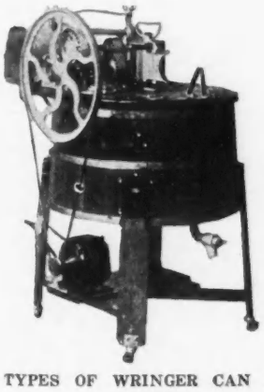
The St. Louis Electrical Works, 4060 Forest Park Boulevard, St. Louis, Mo., are manufacturing an especially designed washing machine motor rated at 1/6 hp. Patented skeleton construction makes the motor exceptionally light and at the same time rigid in construction. Laminations are made of special electrical iron, which, in combination with a patented winding, allows a very low iron loss and therefore high efficiency.

The rotor is keyed solid on the shaft, which is mounted on ball bearings. The motor is entirely inclosed and will operate continuously under full load with a temperature rise of not more than 38 deg. C., and will stand a 50 per cent overload for intermittent service. The motor is waterproof.

The windings are made of enameled wire with a treated cotton covering. The motor is of the split-phase type. The contacts of the centrifugal starting switch are of tungsten. The starting winding is of comparatively large wire and has a separate resistance unit to prevent burn-outs. With the specially designed rotor and stator winding, the starting torque has been made high for a motor of this type. The pull-up torque is 133 per cent of the full-load torque, and the pull-out torque is 200 per cent of the full-load torque. The actual starting torque from a dead standstill is even greater than the pull-up torque.

Washer for Home Use

The important feature of a washer, it is pointed out, is the agitator which imparts motion to the clothes and water. In the machine shown here this is a disk of wood about three-quarters the diameter of the tub. To the lower surface are fastened six cleats, 2 in. (5.08 cm.) deep. These take firm hold on the clothes and will not catch in such a way as to tear them. The weight of rocker shaft and dasher is not great enough to pack the clothes down and prevent the water from circulating freely as the mass is worked back and



TWO TYPES OF WRINGER CAN BE FURNISHED

forth against the corrugated sides and bottom of the tub. Two types of wringer are furnished—one having a safety quick-release feature, the other without it.

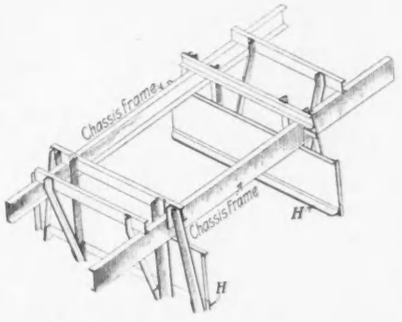
Cypress wood is used in the tub, which is corrugated inside by grooves cut in the wood. It is held together by three hoops of galvanized steel and has a drain spigot in its bottom. On a platform below is mounted a Westinghouse 1/6-hp. splash-proof motor, which can be supplied for direct current or alternating current. This is belted to a flywheel to which is geared the rocker shaft. This is of square section so that it can move to accommodate a varying quantity of clothes in the tub.

The washer is made by the Miller Manufacturing Company of Meyersdale, Pa.

Interchangeable Battery Compartment

W. P. Stone & Company of South Boston, Mass., have developed an interchangeable battery compartment, consisting essentially of a structural steel frame fastened to the truck chassis and provided with shelves on which are suspended duplicating units holding the batteries. An isometric view of the framing is shown herewith.

The frame is suspended from the



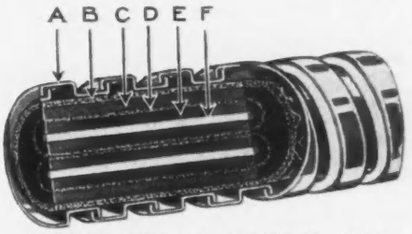
FRAMEWORK OF BATTERY COMPARTMENT

chassis frame by suspending, bracing and trussing irons bolted to channels and designed to provide a rigid support for the duplicating unit, the latter being held in place with the aid of 1⅛-in. (2.8-cm.) dowel pins seated into 1 3/16-in. (3-cm.) holes in the shelves *H*. These dowels complete the truss action on the chassis frame itself, thereby strengthening it at a vital point and giving a wider distribution of the battery load than would otherwise be feasible. Lips are provided on the upper ends of the main hangers to support a part of the weight, and this lessens the strain on the rivets between vertical and horizontal members. Gusset plates connecting the main hangers and braces extend outward under the shelves.

The battery compartment, when assembled, is locked into place automatically by gravity. In four minutes two men with an elevating truck can remove the entire battery and replace it with another fully charged. No jacks, wrenches, levers or other tools are required, and one man can readily handle the smaller sizes of compartment alone. For the cleaning, inspection, flushing or repairing of a battery the compartment affords advantages, as there are no upstanding walls attached to the duplicating platform units. No wheels or rollers are required.

Portable Lamps with Protected Cord

A line of portable lamps is now being marketed by the Inland Electric Company of Chicago designed to lessen the fire and accident hazard of portable wires. The cable is of an unusual type; a cross-section of it is shown herewith. Each conductor has a rub-



CROSS-SECTION OF PROTECTED CORD

ber jacket with braid, which in turn is covered with another rubber jacket surrounding both conductors. An outer braid binds the insulation together. The outer braid is saturated with a waterproof compound which protects the rubber from oil and water. Over this braid is a special armor formed from a No. 30 gage steel ribbon with interlocking flanges which give it strength and flexibility. It can be formed in a loop less than 15 in. (38.1 cm.) in diameter. Its tensile strength is over 160 lb. (72.57 kg.). The cable will not kink or tangle and will lie flat on the floor. An 8-ton (7.25-t.) solid-rubber-tired automobile truck has been run over the armor on a concrete floor without injuring it, it is said. Iron-wheeled trucks will flatten the cable. The attachment plug is screwed on a bushing which is sweated to the armor. The cap of the plug is filled with a compound which keeps the wires from buckling and foreign matter from entering the cable.

The fixture itself is composed of a strong wooden handle with a strong steel guard. At the handle end of the fixture there is additional steel armor which absorbs the strain at this point.

Two types of these fixtures are manufactured. One is a vapor-proof fixture and the other of the open type. In addition to these two fixtures an extension cable is made for portable electric drills. The fixtures have the approval of the National Board of Fire Underwriters.

Christmas Tree Outfit

A prominent feature of the electric Christmas tree outfit now being marketed by the Import Sales Company, 324 East Thirty-second Street, New York City, is the parallel cord with which it is equipped. This type of flexible connection abides by the recommendations in the National Electrical Code. Each outfit is tested before shipment, and the packing is so arranged that the dealer may make his own test without removing the lamps from the case. Sets of these decorative lamps are supplied with eight, sixteen, twenty-four and thirty-two lights, with either tungsten or carbon bulbs.

Trade Notes

I. D. MILBURN has joined the sales force of the Page & Hill Company, Minneapolis, Minn.

H. F. BARDWELL has been appointed New York district manager for the Vanadium-Alloys Steel Company of Pittsburgh and Latrobe, Pa., with offices at 30 Church Street, New York City.

A. L. SMITH, JR., has taken a position with the Rathbone Sard Electric Company as New England representative, with an office at 65 High Street, Boston, Mass. Mr. Smith was range specialist for the Edison Electric Illuminating Company of Boston for a number of years.

J. ANDREWS, JR., has been appointed manager of the industrial division of the Pittsburgh office of the Westinghouse Electric & Manufacturing Company to succeed F. C. Albrecht, who is now in the Ordnance Officers' Reserve Corps, stationed at the Frankford (Pa.) arsenal.

LOUIS J. GROSSMAN of the Grossman Electric Company, Allentown, Pa., having been drafted into the National Army, has closed his local office as well as the one at 115 North Sixth Street, Philadelphia. Henceforth mail for him should be addressed to 503 Tasker Street, Philadelphia.

I. E. LYNCH of the Page & Hill Company, Minneapolis, Minn., is at present acting as general superintendent of stores for the American International Shipbuilding Corporation, Philadelphia. Mr. Lynch is on leave of absence and expects to return to his organization as soon as his present duties are completed.

R. J. MORGAN, who resigned from the Midvale (Pa.) Steel & Ordnance Company, has been appointed supervisor of sales of the American Steel Export Company, New York City. Prior to his connection with the Midvale company Mr. Morgan was for thirteen years with the Carnegie Steel Company, Pittsburgh, Pa.

ARTHUR E. ALLEN, manager of the supply department in the New York district office of the Westinghouse Electric & Manufacturing Company, who is a Canadian, has resigned to join the Royal Engineers. He has been succeeded by Charles E. Stephens, formerly in charge of the illuminating and rectifier section at East Pittsburgh, Pa.

J. W. WHITE, from 1906 to 1912 with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and from 1913 to 1916 with the Bullock Works of the Allis-Chalmers company, Milwaukee, Wis., as special agency representative in charge of dealers and jobbers, has been made manager of the power and railway division of the Detroit office of the Westinghouse company.

THE CHAMBER OF COMMERCE, New York City, has published an address on "Property Rights and Trade Rivalries," by George E. Roberts, assistant to the president of the National City Bank. The address was delivered before the national conference upon the foreign relations of the United States under the auspices of the Academy of Political Science in the city of New York.

TIFFANY, HALL & COMPANY, INC., New York, N. Y., are erecting a twenty-five-thousand-dollar fireproof brick building, 100 ft. by 60 ft., at Seventh and Adams Streets, Hoboken, N. J. The structure is a single-story, modern mill-type structure, on the unit system, special attention being given to the lighting effects. It will be finished and ready for occupancy Dec. 1 and will be devoted exclusively to the overhauling and handling of used motors.

THE GOLDSCHMIDT THERMIT COMPANY, New York City, has opened a new office, repair shop and storeroom at 1427 to 1429 Western Avenue, Pittsburgh, Pa. The branch will be under the direction of H. D. Kelley, who has represented the company in the Pittsburgh district for years. It will also be the headquarters of H. G. Spilsbury, metallurgical engineer, and Edwin B. Bloom, who has been representing the Thermit company for some time in Ohio and western Pennsylvania.

THE BOND FOUNDRY & MACHINE COMPANY, Manheim, Pa., has recently purchased, as a going concern, the plant and good will of the Queen City Foundry Company, Toronto, Can. In the future this new acquisition will be operated as the Bond Engineering Works, Ltd. Besides making gray iron castings, it will manufacture power-transmitting specialties. New buildings will be erected to take care of the increased business. The Canadian works will be under the management of H. M. Lee.

GEORGE A. PAFF, formerly superintendent of the rod and wire mills at the Aliquippa Works of the Jones & Laughlin Steel Company, Woodland, Pa., is now general superintendent at the Monessen Works of the Page Steel & Wire Company. Mr. Paff served in the former capacity eight years, previous to which he was superintendent for five years in the rod and wire mills at the Sharon Works of the American Steel & Wire Company.

Trade Publications

POPPET-VALVE ENGINE.—The Modern Poppet Valve Engine is illustrated in a bulletin prepared by the Nordberg Manufacturing Company of Milwaukee, Wis.

SOCKETS AND RECEPTACLES.—Pass & Seymour, Inc., of Solvay, N. Y., has issued a leaflet announcing a change in the standard length of chain on its pull sockets and receptacles.

SWITCHES.—Alternating-current motor-starting switches for front and back connections are illustrated and described in a leaflet prepared by the Trumbull Electric Manufacturing Company of Plainville, Conn.

HOLDING DRUMS.—The Blaw-Knox Company, Pittsburgh, Pa., has ready a folder on "'Blaw' Holding Drums and Their Limitations" that is considered a "little bit different from the general run of advertising literature."

AUTO LIGHTS.—The Anderson Electric Specialties Company, 562 West Van Buren Street, Chicago, has prepared leaflet No. 102, descriptive of its "Autoreelite," a dirigible searchlight and automatic extension inspection lamp.

CONDENSATION PUMPS.—Bulletin No. C-5000, descriptive of electrically driven condensation return pumps for automatically returning condensation to boilers in low-pressure steam-heating systems, has been prepared by the Yeomans Brothers Company, 231 Institute Place, Chicago.

ELECTRIC FURNACES.—Electric furnaces for melting non-ferrous metals and alloys are illustrated and described in an illustrated catalog prepared by the Electric Furnace Company of Alliance, Ohio. This company has also prepared a bulletin descriptive of its Baily electric furnaces for heating or heat-treating steels and for melting, heating and annealing non-ferrous metals.

SEWER CONSTRUCTION.—A reprint from the *Journal* of the Western Society of Engineers has been issued by the Blaw-Knox Company of Pittsburgh, Pa. This describes the intercepting sewer construction in the northern part of the Sanitary District of Chicago and includes the methods of work and cost data. The paper was prepared by H. R. Abbott, assistant engineer of the Sanitary District of Chicago.

NEW HOUSE ORGAN.—The Lux Manufacturing Company of Hoboken, N. J., has prepared a new house organ known as "Lux Side-Lights." This house organ, which is to be a monthly, is to promote a spirit of co-operation among the various employees of the company even to a greater extent than that which at present exists. In later issues the editors intend to incorporate general data which will be useful to the various distributers of and dealers in Lux lamps and to give sales helps.

NEW ZEALAND TRADE.—"Electric Goods in New Zealand" appears in Special Agents Series No. 147, written by Special Agent Lundquist of the Department of Commerce, Bureau of Foreign and Domestic Commerce. Burrell S. Cutler, chief of the bureau, describes the criticisms of the author as thoroughly constructive and the result of careful study on the spot. Copies of the report for a nominal price—5 cents each—may be obtained from the Superintendent of Documents, Washington, D. C.

MOTOR INSTALLATIONS.—Typical single-phase and polyphase motor installations are illustrated and described in a carefully prepared and well-illustrated bulletin of the Wagner Electric Manufacturing Company of St. Louis. The illustrations in this book show much that is useful to those who are interested in motor drives and to those who are contemplating such installations, and offer in addition proof of fitness of Wagner motors for various installations. This bulletin shows only a comparatively small number of Wagner installations, but these few are chosen as representative of Wagner motor applications and give some idea of the scope and the method of drive and mounting, the distribution of this company's motor installations throughout the country, the type of concerns using these motors, etc.

New Incorporations

THE ELECTRIC VEHICLE COMPANY of Seattle, Wash., has been chartered with a capital stock of $5,000. The incorporators are O. L. Willett and M. M. Preber.

THE HOLDINGFORD (MINN.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of $15,000 by T. C. Gordon of Little Falls and others.

THE NORTHWESTERN LIGHT & POWER COMPANY of Mount Prospect, Ill., has been incorporated with a capital stock of $5,000 by William Busse, Edward Busse, Henry J. Ehard, Ralph L. Peck and Henry Beigel.

THE LAWTON (OKLA.) ELECTRIC & GAS COMPANY has been incorporated by John C. Keys, J. M. Young and A. H. Keys. The company is capitalized at $300,000 and proposes to construct and operate an electric-light and power plant.

THE H. & S. ELECTRIC COMPANY of Charleston, W. Va., has been chartered with a capital stock of $50,000 by Joseph Herzstam, Sidney Kusworm of Dayton, Ohio; H. R. Stapp, K. Stapp and Howard W. Linard, all of Charleston.

THE POLHAMUS COMPANY of Fort Wayne, Ind., has been chartered with a capital stock of $100,000 by Albert Z. Russell, H. and M. J. Polhamus. The company proposes to manufacture oil generators, automobile accessories and tools.

THE ELECTRICAL METALS & MANUFACTURING COMPANY of Youngstown, Ohio, has been incorporated with a capital stock of $150 000 by Frank P. Pyle, Paul H. Stambaugh, William M. Henderson, H. H. Wickham and William Schneider.

THE STANDARD SIGNAL CORPORATION of New York, N. Y., has been incorporated with a capital stock of $1,500 to manufacture and deal in signal devices. The incorporators are: Frank T. Jackson, George A. Lermann and Carl A. Lermann.

THE DOMESTIC RIDGLEY LIGHT & ICE COMPANY of Ridgley, Tenn., has been chartered with a capital stock of $10,000 to construct and operate an electric-light plant and ice factory. The incorporators are: G. S. Riely, J. T. Foster, G. F. Richardson and others.

THE ADAMS-HOLLAND ELECTRIC COMPANY of Revere, Mass., has been incorporated with a capital stock of $25,000 to manufacture and deal in machinery, etc. The officers are: James Buchanan, Jr., of Chelsea, Mass., president; Alfred T. Timayenis of Revere, treasurer and clerk.

THE DOMINION BATTERY COMPANY of Montreal, Que., has been incorporated by Eldon Moir, John Campbell, Donald L. McDonald and others. The company is capitalized at $200,000 and proposes to manufacture dry batteries, flashlights, lamps, electrical goods, machinery, etc.

THE ERNALDSON MANUFACTURING COMPANY of St. Pauls, N. C., has been chartered with a capital stock of $25,000 to do a general electric-lighting and power-supply business. The incorporators are: A. R. McEachern, W. D. Johnson, G. T. Fisher and A. A. McEachern of St. Pauls.

THE IGNITION REPAIR & SUPPLY COMPANY of Toronto, Ont., has been chartered with a capital stock of $40,000 to manufacture engines, motors, batteries, magnetos, etc. The incorporators are: Lawrence J. Pashler, 9 Grafton Avenue; Bertrand T. McAvoy, M. P. Van der Voort and others.

M. J. O'BRIEN, LTD., of Ottawa, Ont., has been incorporated with a capital stock of $20,000,000 to take over the smelter, electric plants, etc., owned by Michael J. O'Brien at Renfrew. The incorporators are: Michael J. O'Brien, Joseph L. Murray, both of Renfrew; John A. O'Brien and others of Ottawa.

THE UNION CARBIDE & CARBON CORPORATON of Niagara Falls, N. Y., has been incorporated by W. H. Billings, E. G. Johnson, E. W. Burdick and C. K. G. Billings, 30 East Forty-second Street, New York, N. Y. The company is capitalized at $15,000,000 and proposes to manufacture calcium carbide, and gas-producing materials and electric batteries.

THE GAROGA (N. Y.) ELECTRIC POWER COMPANY has been incorporated with a capital stock of $200,000 by John T. Norton, William A. Dunne and George C. Lecomte. The company is capitalized at $200,000 and proposes to generate and distribute electricity for lamps and motors and to do a general transportation business. Post office address, Garoga, Johnstown, N. Y.

New England States

SKOWHEGAN, ME.—Plans are being prepared by the Central Maine Power Company of Augusta for a water power development at Skowhegan of from 4000 to 20,000 hp. It is estimated that 25,000 hp. can be developed at a cost of $1,000,000. The plans provide for raising the dam at Skowhegan Falls 7 ft. Half of the present dam is concrete; the other half will be rebuilt with concrete. Other details have not yet been decided upon.

LACONIA, N. H.—A petition has been presented to the City Council asking for an extension of the street-lighting system on Pleasant Street.

RUTLAND, VT.—The Rutland Railway, Light & Power Company is installing a new waterwheel at its Pittsford station. Two new 1000-kw. transformers will be installed in the West Rutland station of the company.

VICTORY, VT.—The Essex Power & Electric Company (a new corporation) has applied to the Public Service Corporation to condemn certain property in Victory, on the headwaters of the Moose River, where a large dam may be constructed.

BEVERLY, MASS.—The Board of Aldermen has voted to instruct the city solicitor to draw up a bill to be presented to the State Board of Gas and Electric Light Commissioners asking for the right of the city of Beverly to maintain a municipally owned electric plant. The board voted to remove a number of large arc lamps in different sections of the city and install incandescent lamps.

NEWPORT, R. I.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a large power plant at the local naval station, to cost about $900,000.

NEW HAVEN, CONN.—The installation of ornamental lamps on Grand Avenue is under consideration by the Board of Aldermen. The plans provide for the erection of 30 lamps from Olive Street to the railroad crossing, near the Second Precinct at East Street.

NEW LONDON, CONN.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a large power house and shop building at the local navy station, to cost about $200,000, to Bigelow & Nichols, 45 East Forty-second Street, New York, N. Y.

PINE MEADOW, CONN.—At a special meeting of the Pine Meadow Fire District it was voted to instruct the executive committee to enter into a contract with the New Hartford Electric Company to furnish not more than 25 street lamps.

WATERBURY, CONN.—The Housatonic Power Company has awarded contract for its new power house, about 60 ft. by 95 ft., to Tracy Brothers, 52 Benedict Street, Waterbury, at about $40,000.

Middle Atlantic States

ALBANY, N. Y.—The Hudson Power Corporation has petitioned the Pacific Service Commission for permission to erect electric transmission lines between Rensselaer and Poughkeepsie to build an electric generating station in Greenport and to exercise the franchise granted by the town of Greenport. The plans of the company provide for supplying electricity for lamps and motors in all the cities, villages and small towns along the upper Hudson and the Catskills. It will also furnish energy to the Albany Southern Railroad Company. The cost of the entire project is estimated at about $1,000,000.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has completed the erection of its new transmission line to the plant of the Endicott-Johnson Company and has inaugurated operations with an initial load of 500 hp., which will be materially increased upon the completion of the new leather board factory of the Endicott company. The power company is preparing to start work at once on increasing the voltage of the tie line to 11,000 volts, the line being constructed for 2300-volt service.

BROOKLYN, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York City, until Nov. 20 for furnishing and installing electric-lighting systems as follows: (1) At the quarters of engine company No. 237; (2) engine company No. 246, borough of Brooklyn. Blank forms and further information may be obtained at the above office.

BUFFALO, N. Y.—The Vulcan Steam Forging Company is building a power house at Reno Street and the Lackawanna Railroad.

BUFFALO, N. Y.—Plans have been prepared by the McClintic-Marshall Construction Company, Pottstown, Pa., for the construction of a new power house on the sea wall strip, about 50 ft. by 85 ft., for the Empire Engineering Company, Marine Bank Building, Buffalo.

CHENANGO FORKS, N. Y.—The Binghamton Bridge Company, Press Building, Binghamton, is reported to be considering the construction of a new hydroelectric plant at its local works.

GAROGA (P. O. JOHNSTOWN), N. Y.—The Garoga Electric Power Company, recently incorporated with a capital stock of $200,000 to generate and distribute electricity for lamps, heat and motors and to do transportation business, is planning to take over the property of the Rockwood (N. Y.) Manufacturing Company, which has built a large dam at Rockwood and established a power house at Garoga Village, 1 mile below, connected by pipe line. The new company, it is understood, proposes to supply electricity to large consumers in central New York. John T. Norton, William A. Dunne and George C. Lecomte, all of Troy, are interested in the Garoga company.

SYRACUSE, N. Y.—Preparations are being made by the Dyneto Electric Corporation, 301 Wolf Street, manufacturer of electrical apparatus, to increase the output of its plan. A four-story brick building, about 75 ft. by 100 ft., has been acquired by the company in Park Street.

TONAWANDA, N. Y.—The Fore River Shipbuilding Company, 57 East Howard Street, Quincy, Mass., has awarded the Aberthaw Construction Company, 27 School Street, Boston, Mass., a contract for the construction of a one-story power house and machine shop at its local works on Vulcan Street.

UTICA, N. Y.—Work has begun on the construction of a new one-story factory about 100 ft. by 400 ft., on Mortimer Street near St. Vincent Street, for the McCoy Iron Works of Perth Amboy, N. J. The plant will manufacture steel and iron products, and will be equipped with considerable electrically operated machinery.

ELIZABETH, N. J.—The Board of Health has recommended to the City Council that the two fuel engines in the city sewage-pumping station be replaced with two electrically driven engines. The Council will be asked to approve an expenditure of $7,500 for the proposed improvement.

MORRISTOWN, N. J.—Preparations are being made by the Morris & Somerset Electric Company for the installation of a new street-lighting system in Green Village. The company will also supply energy for the street-lighting system of the township of Chatham. Work has begun on the erection of the new lines, which will cover a distance of about 2 miles.

NEWARK, N. J.—The United Color & Pigment Company is planning to erect a power plant, 46 ft. by 90 ft., one story, on Evergreen Avenue, near the Pennsylvania Railroad.

NEWARK, N. J.—The Board of Freeholders has granted Piper Brothers, 112 Brunswick Street, Trenton, permission to transfer their contract for alterations and improvements in the power plant at the county hospital at Overbrook to Henderson & Company, 935 Springfield Avenue, Irvington, owing to their plant having been taken over by the government.

NEWARK, N. J.—Plans are being prepared by the Wallington Leather Manufacturing Company, 42 Kent Street, for the construction of a new power house, 48 ft. by 115 ft., in connection with its new plant at 317-325 Frelinghuysen Avenue. The cost of the initial works is estimated at $40,000. Later it is proposed to construct a second unit, with large building for power station, the entire plant to cost approximately $150,000.

ALTOONA, PA.—Bonds to the amount of $53,000 have been issued by the Altoona & Logan Valley Electric Railway Company, the proceeds to be used for improvements, extensions, etc.

CHESTER, PA.—Work has begun on the erection of the electric transmission lines of the Philadelphia Electric Company to Philadelphia. These lines will carry energy generated at the new local station, now under construction, to the central station in Philadelphia.

EASTON, PA.—The Pennsylvania Utilities Company has completed improvements to its Dock Street station which have doubled the output of the plant, including the installation of a new 5000-kw. turbine and two boilers. Two additional boilers and a new feed-water heater will be installed immediately. Improvements have also been made to the South Side plant.

ERIE, PA.—A permit has been granted for the erection of a power house at the new steel plant of the Erie Forge Company, to cost about $75,000. The building will be about 47 ft. by 252 ft., built of concrete, steel and brick.

HAZLETON, PA.—Plans are being considered by the Weatherly Foundry & Machine Company for the construction of a new electric power plant.

LANSDALE, PA.—The Borough Council has approved an agreement with the officials of Chalfont under which the municipal plant will supply electricity for lighting Chalfont for a period of 15 years. A new turbo-generator set has recently been installed in the municipal plant, at a cost of about $12,000.

MORRISVILLE, PA.—The Borough Council is considering the construction of a new municipal electric-light and gas plant.

PHILADELPHIA, PA.—Plans are being prepared by the Philadelphia & Reading Railroad Company for the construction of a new power house at Emerald and Tulip Streets.

PHILADELPHIA, PA.—The Philadelphia Suburban Gas & Electric Company has announced a bond issue of $171,000, the proceeds to be used for improvements to its system.

PHILADELPHIA, PA.—Bids will be received until Nov. 20 for lighting the streets of the city for a period of one year, from Jan. 1 to Dec 31, 1918. George E. Dateman is director.

PHILADELPHIA, PA.—Winfield S. Barnes & Company, 1614 Cherry Street, is contemplating the construction of a power house at its new plant, in the Frankford section, at a cost of about $75,000.

PHILADELPHIA, PA.—Plans have been prepared by F. A. Poth & Sons, Thirty-first and Jefferson Streets, for the construction of an addition, 40 ft. by 50 ft., to its power plant. Charles H. Casper, 925 Chestnut Street, is architect.

PHILADELPHIA, PA.—The Philadelphia Electric Company has petitioned the Public Service Commission for permission to acquire the controlling interest in the Delaware County Electric, the Bala & Merion Electric and the Cheltenham Electric Light, Heat & Power Companies.

PHILADELPHIA, PA.—Plans have been filed by the Hulton P. & P. Dyeing Company, Frankford Junction, for the erection of a new power house, 35 ft. by 110 ft., at Coral and Wagner Streets, to cost about $8,000. F. Compton & Brothers, 4814 Oakland Street, Philadelphia, have been awarded contract.

PHILADELPHIA, PA.—The Badenhausen Company, which will furnish many boilers for the merchant fleet now being built by the Emergency Fleet Corporation, is making extensions and improvements to its plants, involving an expenditure of about $300,000. Machine-tool equipment has recently been purchased for its works at Bound Brook, N. J., known as the Bound Engine & Manufacturing Company, which will build 18 triple-expansion marine engines for merchant ships. The shops at Norristown and Bridgeport, Pa., are being enlarged. An entirely new plant is being built at Cornwells, Pa. A boiler shop, 200 ft. by 275 ft., is the first unit of the Cornwells plant.

POTTSVILLE, PA.—The new ornamental lighting system, which is nearing completion, may not be put into operation until after the war, because of the necessity of saving fuel.

READING, PA.—The Metropolitan Edison Company has recently secured a contract from the Reading Fire Brick Company to furnish 150 hp.

READING, PA.—Bonds to the amount of $3,000,000 have been issued by the Reading Transit & Light Company for improvements and extensions to its system.

READING, PA.—The Metropolitan Edison Electric Company has been awarded a contract by the Prospect Dye Works to furnish electrical service to operate its plant.

WEATHERLY, PA.—The Weatherly Foundry & Machine Company is contemplating the construction of a large power plant in connection with its works.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

WILLIAMSPORT, PA.—Plans are being considered by the United States Rubber Company for the construction of a large power plant at its local works.

NEW CASTLE, DEL.—Contract has been awarded by the Wilmington Fibre Specialties Company for extensions and improvements to its power plant to Harry Lynch, 715 Tatnall Street, Baltimore, Md.

ANNAPOLIS, MD.—Plans are being prepared by the Navy Department, Washington, D. C., for the erection of a high-power radio station at Greenbury Point, across Severn River from Annapolis. The cost of plant and connections is estimated at $1,000,000. Right of way for pole line over the county roads has been secured from the Commissioners of Arundel County. The line will carry 6600 volts. Electricity for the proposed station will be supplied by the Washington, Baltimore & Annapolis Electric Railway Company of Baltimore, Md.

BALTIMORE, MD.—Plans are being prepared for the construction of a new three-story power house addition at the plant of Cockran, Hill & Company at Sixth Street and Wilkens Avenue.

BALTIMORE, MD.—Contract has been awarded by the Crown Cork & Seal Company, Guilford Avenue, to the West Construction Company of Baltimore for the construction of an addition to its power house at Highlandtown.

PEYTONA, W. VA.—The Laurel Branch Coal Company of St. Albans, recently incorporated with a capital stock of $50,000, is contemplating developing 700 acres of coal land, which it is estimated will have a daily capacity of from 500 to 1000 tons. A power plant and mining machinery will be installed. Meredith Moore of St. Albans is vice-president and manager.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 26 for two electrically operated and one steam-operated locomotive jib crane of 50 gross tons capacity for the dry docks at the navy yards, Norfolk, Va., Philadelphia, Pa., and New York, N. Y. Drawings and specifications (No. 2666) may be obtained on application to the above bureau or to the commandants of the navy yards named.

North Central States

DETROIT, MICH.—The Board of Supervisors of Wayne County has instructed the county auditors to include in their 1917 estimates $110,000 for an independent light and power plant to supply electricity to the county buildings.

ONSTED, MICH.—A company has been organized by local residents to construct and operate an electric-light plant in Onsted. The company is capitalized at $8,000. The officers are: Dr. G. W. Ross, president; B. A. Onsted, secretary, and L. L. Curtis, treasurer.

ATHENS, OHIO.—The Central Electric Producing Company has recently completed an addition to its electric producing plant and contemplates the installation of additional equipment.

CLEVELAND, OHIO.—The Cleveland Illuminating Company has applied to the Public Service Commission for permission to issue $3,500,000 in bonds, and surrenders the right to issue $1,039,000 in common stock, which was granted some time ago.

COLUMBUS, OHIO.—The plant of the Ohio Dairy Company is reported to have been purchased by the Blue Valley Creamery Company of Chicago, Ill. The latter company contemplates the construction of a new building, to cost about $50,000, for which refrigerating equipment will be required.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Railway & Light Company has sold $500,000 in bonds, the proceeds to be used for completion of the 20,000-hp. addition to the Lowellville power house, which the company expects to put in operation about Jan. 1, 1918.

ZOAR, OHIO.—The County Commissioners have granted the Zoar Battery Company a franchise to erect electric transmission lines along the highway between Zoar and Mineral City to supply electricity in the latter city for both municipal and commercial purposes.

LOUISVILLE, KY.—The American Tobacco Company, 900 South Eighth Street, has awarded contract to Sanford Vaughan, Paul Jones Building, Louisville, for remodeling its power house.

OWENSBORO, KY.—The plant of the Owensboro Ice Company was recently destroyed by fire, including boiler room, causing a loss of from $25,000 to $30,000.

OWENSBORO, KY.—Preparations are being made by the Rapier Sugar Feed Company, Second and Clay Streets, for the installation of electric motors and other electric equipment in its new plant now under construction.

MALTA, ILL.—The installation of an electric-lighting system in Malta is under consideration by the City Council.

ALMA, WIS.—The property of the Alma Electric Light Company has been purchased by the Wisconsin-Minnesota Light & Power Company of Eau Claire.

EAU CLAIRE, WIS.—The Gillette Rubber Company, which recently completed its new plant, will erect a boiler and transformer house, 65 ft. by 81 ft., with a 175-ft. concrete stack, 15 ft. in diameter. The equipment will include two 315-hp. Stirling boilers, hydraulic pumps, open switchboard and overhead coal bunkers of 650 tons capacity, equipped with automatic stokers. R. B. Gillette is vice-president and general manager.

FOND DU LAC, WIS.—Work has been begun on the installation of a new 500-hp. boiler at the plant of the Eastern Wisconsin Electric Company on West Rees Street. An addition 44 ft. by 31 ft. will be erected to provide space for the new boiler, which will be fed by automatic underfed stokers. The smokestack will be 183 ft. in height.

GRESHAM, WIS.—At special election held recently bonds to the amount of $14,000 were voted the proceeds to be used for the purchase of the electric-lighting plant and water-works system owned by Richards Brothers.

MANCHESTER, MINN. —Preparations are being made for the installation of an electric-lighting system in Manchester for which $8,000 in bonds has been voted.

ST. PAUL, MINN.—Plans are being prepared by Oscar Claussen, city engineer, for extensive river improvements, which will involve an expenditure of $1,200,000 and include an electric belt line, warehouses, cold storage, grain elevator, dockage, etc., and a municipal electric-light plant. The cost of the electric plant is estimated at $200,000, to be erected on the river front; it will utilize Illinois coal and furnish electricity to the city departments only. The proposal to issue $1,200,000 in bonds for the work will be submitted to the voters in 1918 if the project receives the approval of the War Department.

CEDAR RAPIDS, IOWA.—Contract has been awarded by the Quaker Oats Company to the Leonard Construction Company for the construction of a substation, 81 ft. by 42 ft., on C Avenue, between Fifteenth and Sixteenth Streets, East, to cost about $8,000.

CORWITH, IOWA.—Bids will be received by the board of education of the consolidated district of Corwith until Nov. 26 for construction of school building, to cost about $70,000. Separate bids to be submitted on heating, plumbing and electric wiring. Proudfoot, Bird & Rawson, Hubbell Building, Des Moines, Iowa, are architects. W. C. Oelke is secretary of board.

KESWICK, IOWA.—The local electric-light plant, it is reported, was recently destroyed by fire.

MIDDLETOWN, IOWA. — Preparations are being made for the installation of an electric-lighting system in Middletown. A transmission line will be erected from Burlington to transmit electricity generated at the Keokuk dam here. It is expected to have the system completed by the latter part of the month.

SIOUX CITY, IOWA.—A permit has been granted to the Sioux City Gas & Electric Company for the construction of an addition to its plant, to cost about $25,000. The building will be 27 ft. by 37 ft. and will provide space for a new electric generator.

STRAHAN, IOWA.—Bids will be received by the board of directors for the consolidated school district of Strahan until Nov. 30, including electric, heating and plumbing works. Plans and specifications may be obtained at the office of W. F. Gernandt, Keeline Building, Omaha, Neb, for which a deposit of $20,000 will be required for "A," covering general contract, including electric work; "B," deposit of $10, covering heating, ventilating and plumbing. The cost of the building is estimated at $50,000. H. Kayton is secretary of board.

KANSAS CITY, MO.—Preparations are being made by the Missouri & Kansas Interurban Railway Company for the installation of coal-burning equipment. When this is done the company will generate electricity to operate its car lines outside of the city limits of Kansas City. At present the company gets its energy, both inside and outside the city, from the Kansas City Railways Company, putting into service in emergencies a gas-burning plant at Overland.

BANTRY, N. D.—Arrangements have been made to install an electric-lighting system in Bantry. A small plant has been installed temporarily, which will be replaced by a larger one as soon as machinery arrives.

CRARY, N. D.—A franchise has been granted to John W. Ebert to install and operate an electric-lighting plant in Crary for a period of 20 years.

TIOGA, N. D.—The Council is considering an issue of $6,000 in bonds for the installation of an electric-lighting system in Tioga.

OCONTO, NEB.—An election will soon be held to vote on the proposal to issue $3,900 in bonds for the installation of a municipal electric-light plant (initial unit).

ORD, NEB.—The contract for construction of the proposed municipal electric-light plant has been awarded to the Merkle Machinery Company of Kansas City, Mo., at $27,000.

ARKANSAS CITY, KAN.—Preparations are being made for improvements to the local plant of the Kansas Gas & Electric Company of Wichita. The plans provide for doubling the output of the plant. The work will be in charge of the Phoenix Construction Company of Wichita.

HURON, KAN.—Preparations are being made by B. R. Hinchman of Lancaster to install an electric-lighting system in Huron. Mr. Hinchman, it is said, will tap the electric transmission line which extends from Atchinson to Everest and erect an extension to Huron.

LAWRENCE, KAN.—The general contract for construction of administration and liberal arts building at the University of Kansas at Lawrence has been awarded to Olson & Johnson, Omaha, Neb., at $208,390. Separate contracts will be awarded for heating, plumbing, electric wiring, electric fixtures, etc., later, part to be installed by day labor. The cost of the building complete is estimated at about $300,000. J. A. Kimball of Topeka is business manager of board of administration.

McCRACKEN, KAN.—Bonds to the amount of $12,000 have been voted for improvements to the municipal electric-light plant and water works system. W. B. Rollins & Company, Railway Exchange, Kansas City, Mo., are engineers.

MANHATTAN, KAN.—The plant of the Rocky Ford Milling & Power Company, located on the Blue River near Manhattan, has been purchased by a company organized by A. D. Jellison, Harry Pierce of Junction City, D. A. Rogers and C. L. Brown of Abilene. The new owners, it is understood, will remodel and double the output of the plant. Work has begun on the extension of the transmission lines of the Riverside Power & Light Company of Abilene to connect with the lines of the Rocky Ford Company, which furnishes electricity to Camp Funston.

Southern States

ELKIN, N. C.—The Chatham Manufacturing Company is contemplating building an addition to its plant, 300 ft. by 80 ft., three and five stories high, to cost about $65,000. One hundred looms and accompanying equipment, including a steam power plant, will be installed, at a cost of about $200,000.

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 26 for power plant improvements, including piping and accessories, coal bunkers, structural steel foundations, induced-draft fans and miscellaneous work in connection with the installation of new equipment in the power plant at the navy yard at Charleston. Drawings and specifications (No. 2661) may be obtained on application to the above bureau or to the commandant of the navy yard named.

COLUMBIA, S. C.—The City Council is considering the installation of motor-driven pumps to increase the water supply. A report submitted by F. C. Wyse, engineer and superintendent, estimates the cost of installing one 3,000,000-gal. and two 5,000,000-gal. electrically driven pumps, with necessary equipment and building, at $30,000. Bids for the above, it is understood, will be asked by the Water Works Department.

ATLANTA, GA.—The Pratt Engineering & Machine Company has contracted with the Georgia Railway & Power Company for energy to operate its entire plant. About 400 hp. will be required. The Pratt company is in the market for one 500-cu. ft. motor-driven air compressor, one 100-kw. motor-generator set, pumps and cupola blower; service 550 volts, three phase, 60 cycles.

ATLANTA, GA.—The Department of Justice, Washington, D. C., will build a weave shed, 457 ft. by 210 ft., for the United States Penitentiary cotton duck mill. The building will be equipped with 500 light and medium looms, with 1050 hp. electric power drive. An appropriation of $129,500 has been made for this plant. Lockwood, Greene & Company, Healy Building, Atlanta, Ga., and Boston, Mass., are architects and engineers.

DECATUR, GA.—The Georgia Railway & Power Company of Atlanta is planning to extend its high-tension transmission line from Emory University to the Decatur plant, a distance of about 2 miles. The company has a contract to furnish electricity to operate the pumping station of the municipal water-works system.

MEMPHIS, TENN.—The W. G. Simmons Company, it is reported, is in the market for second-hand machinery, including 1-ton to 2-ton alternating-current, electrically driven hoist, 220 volts, 60 cycles, and a 100-hp. portable boiler in good condition.

BIRMINGHAM, ALA.—The contract for the construction of nurses' home, help's cottage, power house, sewage disposal, water-works and outside wiring for hospital has been awarded to the Inglenook Construction Company of Birmingham. Other contracts were awarded as follows: For generators, motor, switchboard and storage batteries to the McClary-Jemison Machinery Company of Birmingham; oil engine, shafting and belting, McBee Engine & Implement Company of Memphis, Tenn.; refrigerating plant to the United Iron Work Company of Springfield, Mo. B. Price, Empire Building, Birmingham, is architect.

DECATUR, ALA.—Bonds to the amount of $50,000 have been voted for the installation of a municipal electric-lighting plant in Decatur.

NATCHEZ, MISS.—The Natchez Manufacturing Company, recently incorporated with a capital stock of $50,000 to operate the Natchez cotton mills, is planning to equip the mills for electrical operation throughout.

BUFFALO, ARK.—The Standard Zinc Company is reported to be contemplating the construction of a hydroelectric plant on Buffalo River.

MOUNTAIN HOME, ARK.—The Halt Orchard & Development Company, it is reported, is contemplating a large water-power development on the Northfork River. The project includes a tunnel through a narrow neck of a large bend, which is 6 miles around and about 1500 ft. through. The company proposes to use the power in the smelting of iron ore. C. E. Kimberlin is a representative of the company.

BRISTOW, OKLA.—The Council is considering the purchase of the electric plant of the Bristow Ice & Light Company, to be owned and operated by the municipality. If this plant cannot be purchased it is proposed to construct a municipal plant.

LAVERNE, OKLA.—An election will soon be held to vote on the proposal to issue $13,000 in bonds for the purchase of the property of the Laverne Light, Power & Ice Company. Extensions will be made to the system if taken over by the city.

LAWTON, OKLA.—The Lawton Gas & Electric Company, recently incorporated with a capital stock of $300,000, proposes to construct and operate an electric light and power plant. John C. Keys, J. M. Young and A. H. Keys are interested in the company.

LOCO, OKLA.—The installation of an electric-lighting system in Loco is under consideration. C. A. Fletcher & Company of Loco and Ringling are reported interested in the project.

MIAMI, OKLA.—Bids, it is reported, are being received by the Portland Lead & Zinc Company of Miami for four 100-hp. steam boilers, one 200-hp. Corliss engine, 18-in. crushers, gas engine and other machinery. Edward Nix is manager.

OKLAHOMA CITY, OKLA.—The contract for electric wiring for the new factory of the Siefers Candy Company, 517 Grain Exchange Building, has been awarded to the Oklahoma Electrical Supply Company. The cost of the building is estimated at $90,000.

AMARILLO, TEX.—The County Commissioners have decided to install an ornamental lighting system.

BEAUMONT, TEX.—The Beaumont Iron Works is contemplating the installation of additional machinery, including electric transformers at its plant.

COOKVILLE, TEX.—The installation of an electric-light and power plant in Cookville is under consideration. B. B. Stevens of Cookville is reported to be interested in the project.

JEFFERSON, TEX.—The Jefferson Ice & Light Company is considering the installation of a new electric motor and other equipment in its plant.

LAMPASAS, TEX.—The installation of additional machinery and equipment is reported to be under consideration by the Lampasas Light & Power Company.

LUBBOCK, TEX.—The city will soon be ready to connect the street lamps with the city plant. A movement is under way to extend the ornamental lighting system in the near future.

SAN ANTONIO, TEX.—The City Ice & Fuel Company, recently incorporated with a capital stock of $50,000, is contemplating the construction of an ice factory. J. P. Wilhelm is interested in the company.

Pacific and Mountain States

OLYMPIA, WASH.—Bids will be received by the Board of Control, Olympia, until Dec. 1 for the construction of a power and electric plant at the State School for Girls. The cost of the work is estimated at $65,000.

PROSSER, WASH.—Final details of the plans for the proposed pumping station to be installed, at a cost of about $200,000, near Prosser, for lifting water from the Sunnyside canal to irrigate 2000 acres, have been decided upon by the Prosser Irrigation District and R. K. Tiffany, representing the United States Reclamation Service. Site for the pumping station has been purchased and as soon as the Supreme Court passes upon the validity of the issue of the bonds, which the government will take, work will begin on construction of the pumping station and distribution system.

SEATTLE, WASH.—Bids will be received by the Board of Public Works until Nov. 23 for furnishing complete lighting system for the harbor patrol boat. Bids will also be received on the same date for the installation of a power plant in the harbor patrol boat to be built for the City Harbor Department.

SEATTLE, WASH.—Plans are being prepared by the Skinner & Eddy Shipbuilding Corporation for extensions to its plant, which will involve an expenditure of about $1,000,000, and will include a foundry, 60 ft. by 150 ft., adjoining the third machine shop, now under construction, power house and punch shop equipped with six machines.

TACOMA, WASH.—H. F. Gronen, commissioner of the Light and Water Department, has requested the city attorney to frame an ordinance for immediate introduction in the City Council providing for an issue of $4,000,000 in bonds for the purchase of a power site.

TACOMA, WASH.—The contract for the installation of a sewer, water and lighting system for the Amusement Midway to be built at the American Lake Cantonment, Camp Lewis, near Tacoma, at a cost of $1,500,000, under the government supervision, has been awarded to Porter Brothers, general contractors of Spokane and Portland, Ore.

OROVILLE, CAL.—The construction of a large hydroelectric plant is reported to be under consideration by the owners of the Bloomer Quartz Mine.

SANTA ANA, CAL.—The Pacific Electric Railway Company, it is reported, is contemplating extending its railway from Santa Ana through Tustin to Irvine, and eventually to San Diego.

CATALDO, IDAHO.—The erection of an electric transmission line, 45 miles long, from Cataldo, via Fourth July Canyon to Coeur d'Alene is under consideration by the Washington Water Power Company of Spokane. The cost is estimated at $200,000.

GLENWOOD, UTAH.—The Utah Power & Light Company of Salt Lake City has petitioned for a franchise through a portion of Glenwood.

BISBEE, ARIZ.—The City Council is considering calling an election to submit the proposal to issue $375,000 in bonds, the proceeds to be used for the construction of a new electric-light plant, water-works system and a gas-generating plant.

SNOWFLAKE, ARIZ.—Steps have been taken by the residents of Snowflake, Taylor and Shumway to organize a company to construct and operate an electric-light and power plant to furnish electricity in the three towns. The company will be capitalized at $50,000, and will be known as the Silver Creek Electric Light Company. Work will begin on the proposed plant at once.

YUMA, ARIZ.—The City Council has called an election to vote on the proposal to issue $300,000 in bonds for the purchase of the local water, electric-light and power and gas plants or the installation of new ones. The Council has asked T. E. Trask of Los Angeles, Cal., to obtain an option on the existing plants in Yuma as a basis for an action in the direction of municipal ownership of public utilities.

MISSOULA, MONT.—Plans have been decided upon for the installation of a lighting system for the State University campus, which provides for the erection of nine 400-cp. lamps on iron brackets on the driveway and similar lamps throughout the campus grounds.

CARSON CITY, NEV.—Arrangements are being made by the Truckee River General Electric Company for the installation of a new lighting system on Carson Street. It is proposed to replace the arc lamps now in use with 14 nitrogen-filled lamps.

ELY, NEV.—The Eastern Nevada Power Company has been granted permission to issue 1000 shares of capital stock at par ($100 per share), the proceeds to be used for the development of the Ruby Mountain power project in Nevada. The cost of building the first unit, which will develop 4800 hp. delivered at Ely, 150 miles from the power house, will be about $1,100,000. Frank B. Ench of Oakland, Cal., is interested in the company.

LOVELOCK, NEV.—The Liberty Gold Mines Company, recently incorporated by local men, is planning to extend and operate a mine on the easterly slope of Lime Mountain on Deep Creek, about 70 miles from Elko. Plans are under way for the construction of a 100-ton mill, which will be operated by electricity transmitted from the power plant located on Bull Run Creek, about 4 miles distant.

CLOVIS, N. M.—The Board of County Commissioners has granted the State Line Utilities Company a franchise to erect an electric high-tension transmission line from Texico to Clayton and Portales.

TEXICO, N. M.—C. A. Roberson of the Cannon Ball Motor Company of Texico, it is reported, is in the market for equipment, etc., for foundry, including electrical machinery, heating and ventilating apparatus, air-washing machinery, power house equipment and machinery for manufacturing automobiles, trucks and tractors.

Canada

DELTA, B. C.—A petition has been filed with the City Council by land owners in the East Delta District, asking for the installation of an electrically operated pumping station in that section, to cost about $12,000.

ARMAGH, QUE.—Plans are being prepared by Gauvin & Beauchemin, civil engineers, Quebec, for a power development at Armagh on the River Fourche-du-Nord-Ouest. Tenders, it is understood, will be received by the engineers for water turbines, generators, sluicegates, penstock, wooden pipes, etc.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until Dec. 10 for refrigerating apparatus, electric freight elevators, track rollers, ice crusher, ice elevator, etc. Blanks and information may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street ,New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Nov. 30 for furnishing steel, car wheels, steel pipe, boiler tubes, chain, bronze bars, copper tubing, gommets, refrigerating apparatus, refrigerator doors, gage lamps, steam whistles, grease cups, etc. Blanks and information relating to this circular (No. 1182) may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

HONOLULU, H. T.—Contract has been placed with Catton, Neil & Company of Honolulu for equipping the Ewa plantation mill for electrical operation. The equipment will include a General Electric Curtis steam-turbine-driven generator, 750 kw., 480 volts, 60 cycles, switchboard and complete equipment for an electric generating plant.

Record of Electrical Patents

Notes on United States Patents issued on November 6, 1917

1,245,151. MOUNTING FOR CIRCUIT BREAKERS; Nicholas J. Conrad, Chicago, Ill. App. filed Feb. 2, 1917. Particularly for high-tension fuses and switches.

1,245,187. INCLOSED ELECTRIC FUSE; Leonard B. Buchanan, Woburn, and Franklin N. Conant, Newburyport, Mass. App. filed Jan. 8, 1914. Improved form of renewable fusible element and of means for detachably connecting the same to the terminals.

1,245,194. MOTOR-CONTROL SYSTEM; George N. Crabbe, Cresskill, N. J. App. filed March 21, 1914. Is adapted, among other things, automatically to prevent a too sudden reversal of an electric motor.

1,245,259. MAIL APPLIANCE; William H. Milleville, Chicago, Ill. App. filed Aug. 14, 1915. For facilitating the delivery of mail.

1,245,282. DRAFT REGULATOR FOR FURNACES; Allen M. Smith, Fort William McKinley, Philippine Islands. App. filed Nov. 27, 1916. Improvements.

1,245,305. RECEPTACLE; Ernst G. K. Anderson, Chicago, Ill. App. filed Jan. 3, 1916. In which the contacts are electrically dead until an insertible member is introduced in the receptacle.

1,245,326. CANDELABRUM SOCKET; Edgar H. Freeman, Trenton, N. J. App. filed March 22, 1917. Improvements.

1,245,356. PROCESS OF INTERCONVERTING HIGH-POTENTIAL POLYPHASE AND DIRECT ELECTRIC CURRENTS AND TRANSMITTING POWER; Carl G. Koppitz, Youngstown, Ohio. App. filed Oct. 10, 1912. The invention involves the flow of polyphase currents to or from and through a fixed winding, and the flow of direct currents to or from the collector brushes, pulses of direct current jumping across the spaces between these brushes and fixed segments connected by spaced leads to different portions of a closed winding in inductive relation to or included in the polyphase circuits, the brushes rotating in synchronism with the cycles of alternating current, thereby remaining at a predetermined point on the emf. wave. The segments and brushes are preferably cooled and the arcs extinguished by blasts of pre-cooled non-oxidizing gas, caused to impinge upon them by fans carried by the brushes, the portions of gas heated by the serveral arcs being electrically insulated as they flow away from the segments and being delivered to a separate cooler.

1,245,368. SPARK-PLUG TESTER; Wilmer M. Near, Shelby, Mich. App. filed April 14, 1917. May be easily carried in one's pocket or occupy very little space in a tool box or kit.

1,245,428. COVER FOR STORAGE BATTERIES; William L. Bliss, Niagara Falls, N. Y. App. filed April 17, 1914. Will prevent the entrance of dust and dirt into the battery and the escape of fumes therefrom.

1,245,459. ELECTRIC HEATING DEVICE; John A. Heany, New York, N. Y. App. filed Nov. 12, 1914. Contemplates a heating unit in which the body portion is made of a metal having the capability of developing high hysteresis and eddy-current effects.

1,245,464. ENGINE-STARTING DEVICE; John J. Kane, Milwaukee, Wis. App. filed Dec. 22, 1913. Motor vehicle.

1,245,467. DISPLAY SIGNAL; Elmer J. Kingsbury, Chicago, Ill. App. filed Sept. 25, 1916. Particularly adapted to that character of sign in which a plurality of individual units is utilized to make up a complete sign.

1,245,505. ELECTRICAL CARD-TABULATING MACHINE; James Powers, New York, N. Y. App. filed Aug. 21, 1915. Relates to accounting machines co-operating with record cards.

1,245,518. ELECTRIC MUSICAL INSTRUMENT; Melvin L. Severy, Los Angeles, Cal., and George B. Sinclair, Georgetown, Me. App. filed Feb. 8, 1916. Improvements.

1,245,523. REGENERATIVE BRAKING SYSTEM FOR ELECTRIC MOTORS; Norman W. Storer, Pittsburgh, Pa. App. filed Sept. 7, 1916. The object is to increase materially the efficiency of an electric railway distributing system by effectively utilizing the energy, usually dissipated in the form of heat, which is released when railway vehicles are brought to rest from relatively high speed or are run down hill with the brakes set.

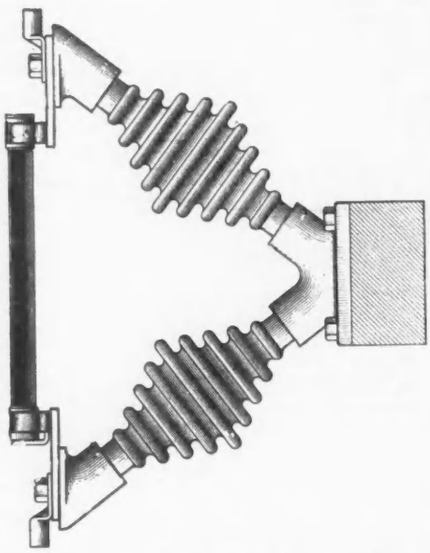
1,245,532. CONTROLLER FOR MOTOR-DRIVEN MACHINES; Frank P. Townsend, Milwaukee, Wis., and Wilmar F. Lent, New York, N. Y. App. filed Sept. 18, 1916. Provides means whereby the mill rolls will be disconnected from the driving motor during reversal thereof and thereafter automatically reconnected to said motor.

1,245,551. MOTOR CONTROLLER; Thomas E. Barnum, Milwaukee, Wis. App. filed Sept. 18, 1915. Provides a controller which will automatically return to its initial position when released from either starting or running position.

1,245,570. PUSH BUTTON; William J. Cook, Charlotte, N. C. App. filed June 26, 1916. One object is to provide an improved construction in which sticking or jamming of the parts is impossible.

1,245,588. RECORDING DEVICE FOR METERS; Angus S. Hibbard, Chicago, Ill. App. filed July 23, 1915. By burning a permanent record of the meter indication onto a sheet of paper prepared for such record.

1,245,592. MULTIPLE RESETTING FUSE; Joseph W. Huebner, Milwaukee, Wis. App. filed Sept. 30, 1916. Provision of a device including a plurality of fuse elements adapted for selective inclusion in a circuit whereby should a fuse burn out a fresh fuse may be immediately substituted.



1,245,151—Mounting for Circuit Breakers

1,245,627. CIRCUIT CONTROLLER; Arthur Simon, Milwaukee, Wis. App. filed Oct. 30, 1914. In the control of electric motors it is common to provide overload protective means to be included in circuit for running and to be temporarily excluded from circuit in starting, and this invention has among its objects to provide improved means for controlling the connections of such protective means.

1,245,628. SPRING TERMINAL FOR BINDING POSTS; Charles H. Smith, Chicago, Ill. App. filed Dec. 26, 1912. Improvements.

1,245,654. MASTER CLOCK; Kikokichi Abe, Yamagata-Ken, Japan. App. filed July 29, 1916. Provides a master clock which will generate the necessary electric current by means of a self-contained generator.

1,245,665. REGISTERING MECHANISM; William J. Bohan, St. Paul, Minn. App. filed May 4, 1914. Improvement.

1,245,673. ELECTRIC FITTING; Frank V. Burton, Bridgeport, Conn. App. filed March 21, 1917. Particularly adapted to fittings of the type designed to be secured at the end of a wire conduit.

1,245,699. ELECTRIC-LAMP SOCKET; Frederic P. Gates, Hartford, Conn. App. filed April 11, 1916. Improvement.

1,245,701. SHORT-CIRCUITING DEVICE FOR MOTORS; Michael I. Ginsburg, Baltimore, Md. App. filed Aug. 24, 1916. Provision of an improved short-circuiting device which automatically comes into play when the armature attains a predetermined rotative speed, whereby the windings of the armature are short-circuited.

1,245,717. ELECTROMAGNETIC SEPARATOR; Clark T. Henderson, Milwaukee, Wis. App. filed June 20, 1914. Provides improved means for extracting free magnetic particles from flowing substances.

1,245,746. ELECTRICALLY HEATED BED-LASTING MACHINES; Edwin N. Lightfoot, New York, N. Y. App. filed March 19, 1917. Applies more particularly to means for heating the same electrically.

1,245,753. THERMOSTAT; Merle M. Mason, Cleveland, Ohio. App. filed June 11, 1914. A feature is that the main body of the mechanism, the electric contacts, etc., are so constructed that the thermostat may be utilized without bringing these delicate parts into contact with extreme temperatures. Another feature provides adjustment for a wide range of temperature.

1,245,762. ALTERNATING-CURRENT MOTOR; Alfons H. Neuland, New York, N. Y. App. filed Aug. 7, 1915. The invention has for a general object the production of a motor operable with alternating current, and particularly with single-phase alternating current, the speed and torque of which may be varied within wide limits by simple mechanism and easy manipulation.

1,245,817. FLASHLIGHT CARRIER; Haakon Suserud, Montreal, Quebec, Canada. App. filed March 2, 1917. Provides a convenient means for holding a flashlight in operative position for the user during the process of writing.

1,245,821. T-HEAD CONSTRUCTION; Wade B. Thompson, Detroit, Mich. App. filed July 5, 1916. This invention relates to a T-head construction and has for its primary object to provide a T-head having the inherent properties of attaching itself to surfaces of certain characteristics.

1,245,823. AUTOMATIC SPEED REGULATOR; Stonewall Tompkins, New York, N. Y. App. filed March 10, 1914. This invention relates to a means for changing the power output of a prime mover or motor which drives an electric generator so as to meet the conditions of demand upon the generator for electric energy.

1,245,860. ELECTRICALLY DRIVEN TOOL; Samuel D. Black and Alonzo G. Decker, Baltimore, Md. App. filed Dec. 4, 1914. Improvements.

1,245,863. ELECTRIC FUSE; Ralph C. Bronson, Chicago, Ill. App. filed Oct. 23, 1914. Provides an electric fuse particularly adapted for comparatively heavy currents and arranged so that when the fusible strip is blown out the hot metal will not be scattered about and so that the fusible strip can easily, quickly and cheaply be replaced.

1,245,940. INSULATOR; Richard H. Marvin, East Liverpool, Ohio. App. filed May 11, 1916. Particularly for insulators of the multi-unit type.

1,245,949. ELECTRIC-LAMP SOCKET; Arvid H. Nero, New Britain, Conn. App. filed July 8, 1916. Provides a device which may be applied to an ordinary lamp socket in order to form therewith an electric fitting of the candle type.

1,245,954. VALVE FOR JOLT RAMMING MACHINES; William C. Norcross, Terre Haute, Ind. App. filed Oct. 21, 1916. Has for its object the provision of an improved spring device or means co-operating with the valve and with the solid lower end of the piston in a novel manner whereby accidental or premature displacement of the valve is prevented and the valve remains where kicked until kicked back to its other position by the opposite reciprocation of the piston.

1,245,956. ELECTRICAL MEASURING APPARATUS; Edwin F. Northrup, Princeton, N. J. App. filed May 15, 1917. Particularly for determining the magnitude of an unknown emf., and when the source of the unknown emf. is a thermocouple the measuring apparatus may be used as an electric pyrometer.

1,245,980. INSULATING COMPOUND AND PROCESS OF MAKING THE SAME; Sadakichi Satow, Sendai, Japan. App. filed Dec. 30, 1916. The object of the invention is to utilize vegetable proteids in the manufacture of compounds for use as insulating material and to produce therefrom insulation for electricity in the desired form for use wherever such insulation is required.

1,245,993. CONTROLLING INDUCTION MOTORS; Richard Van R. Sill, New York, N. Y. App. filed Feb. 3, 1914. Invention embodies improvements.